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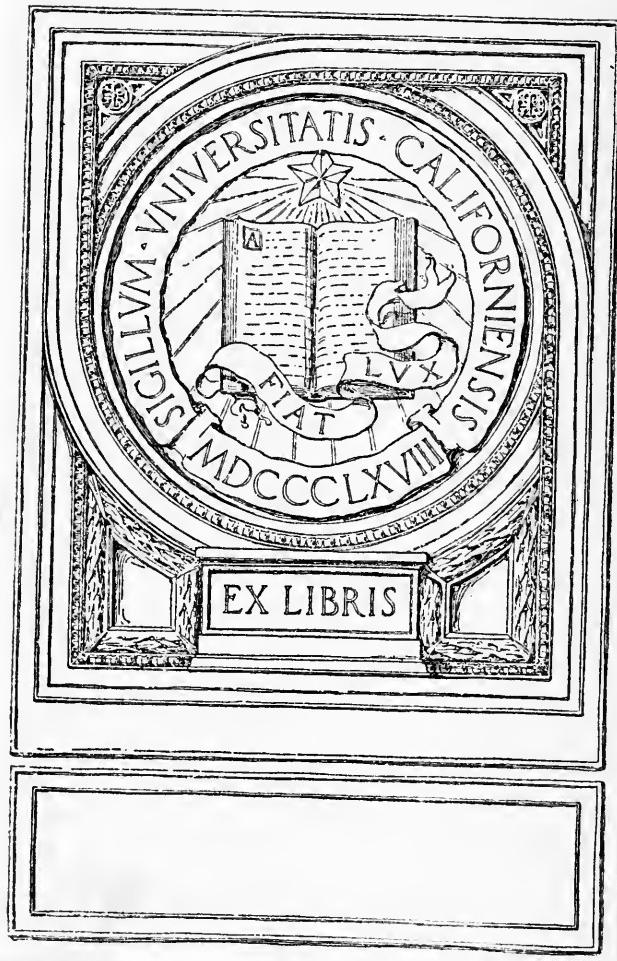
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OUTLOOK
GEOGRAPHY

THE HOME OF
MAN
AMERICA

BY
W. G. BROWN MA.
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THE HOME OF MAN

PART III AMERICA

BY

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PREFACE

HAVING regard to the enormous growth of transatlantic commerce, to the unceasing emigration from Europe to the American continent, and to the tremendous commercial and economic development of the North American countries during the last twenty years, the authors do not feel that any explanation is necessary for the somewhat unusual sequence they have given to the study of the continents. With all the improvements of the twentieth century, both in locomotion and in communication, there is no question that America is for all practical purposes nearer to us than Asia.

It may be pointed out, however, that in order to meet the wishes of those who may for one reason or another prefer to complete the study of the Old World before proceeding to the Western Hemisphere, each book commences with a study of general oceanic and climatic conditions.

We would again express our indebtedness to those friends who have so ably helped us with this and preceding parts.

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PART III

AMERICA

CHAPTER I

OCEAN DEPTHS, WINDS, AND CURRENTS

England, bound in with the triumphant sea,
Whose rocky shore beats back the envious siege
Of watery Neptune.

SHAKESPEARE, *Richard II*

THE area of the British Isles is about 120,000 square miles, of the British Empire $11\frac{1}{2}$ millions, of the Ocean 145 millions. Yet the British claim to be rulers of the sea, and not without some reason, for more than one-half the world's shipping sails under the British flag and it is protected by the most powerful navy the world has ever seen. But it is a big task that these little islands have set themselves in striving to maintain their position, and one which calls for much self-sacrifice on the part of every citizen of the Empire.

Knowledge, however, is power, and if that mastery is to be maintained it will be essential to gain and make use of all possible information with regard to our watery empire—hence the far greater attention which is now paid to the problems of the ocean than in former times.

Let us first, therefore, study in detail the chief features

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of the Atlantic, as being the most important of the five great oceans.

Name the remaining four. Compare their sizes with that of the Atlantic. Suggest reasons for their being of less importance. Measure the breadth of the Atlantic (a) from Bergen to C. Farewell; (b) from C. Clear to Newfoundland; (c) from Gibraltar to C. Hatteras; (d) from Sierra Leone to Georgetown (Brit. Guiana); (e) from Cape Town to Monte Video.

What is the average breadth? If the Arctic and Antarctic Circles be taken as northern and southern boundaries, what is roughly its area? Ans: circa 25,000,000 square miles.

Though the Atlantic is not the largest ocean, yet it receives the drainage of by far the greatest land area, owing to the fact that nearly all the world's great rivers flow either directly or indirectly into it, while, except from eastern Asia, the Pacific receives only very short streams.

To what extent is this dependent upon the situation of the chief mountain ranges of the world?

Name the chief seas connected with the Atlantic. Notice the comparatively small number connected with the Pacific and Indian Oceans. What straits connect the Atlantic with the Arctic Ocean? How is it connected with the Antarctic? How can ships travel from the Atlantic (a) to the Indian Ocean, (b) to the Pacific?

The question of ocean depths has always interested mankind, but it is only during the last half-century that reliable soundings have been obtained. These show us (see fig. 1) that the ocean deepens at first quite gradually in a direction westward from our islands, forming what is known as a continental shelf; at the edge of this shelf its depth then increases more rapidly to an average of 1500 fathoms until America is approached, and a similar continental shelf is again reached. Farther south, however, this is not the case. Thus at the equator the ocean depth

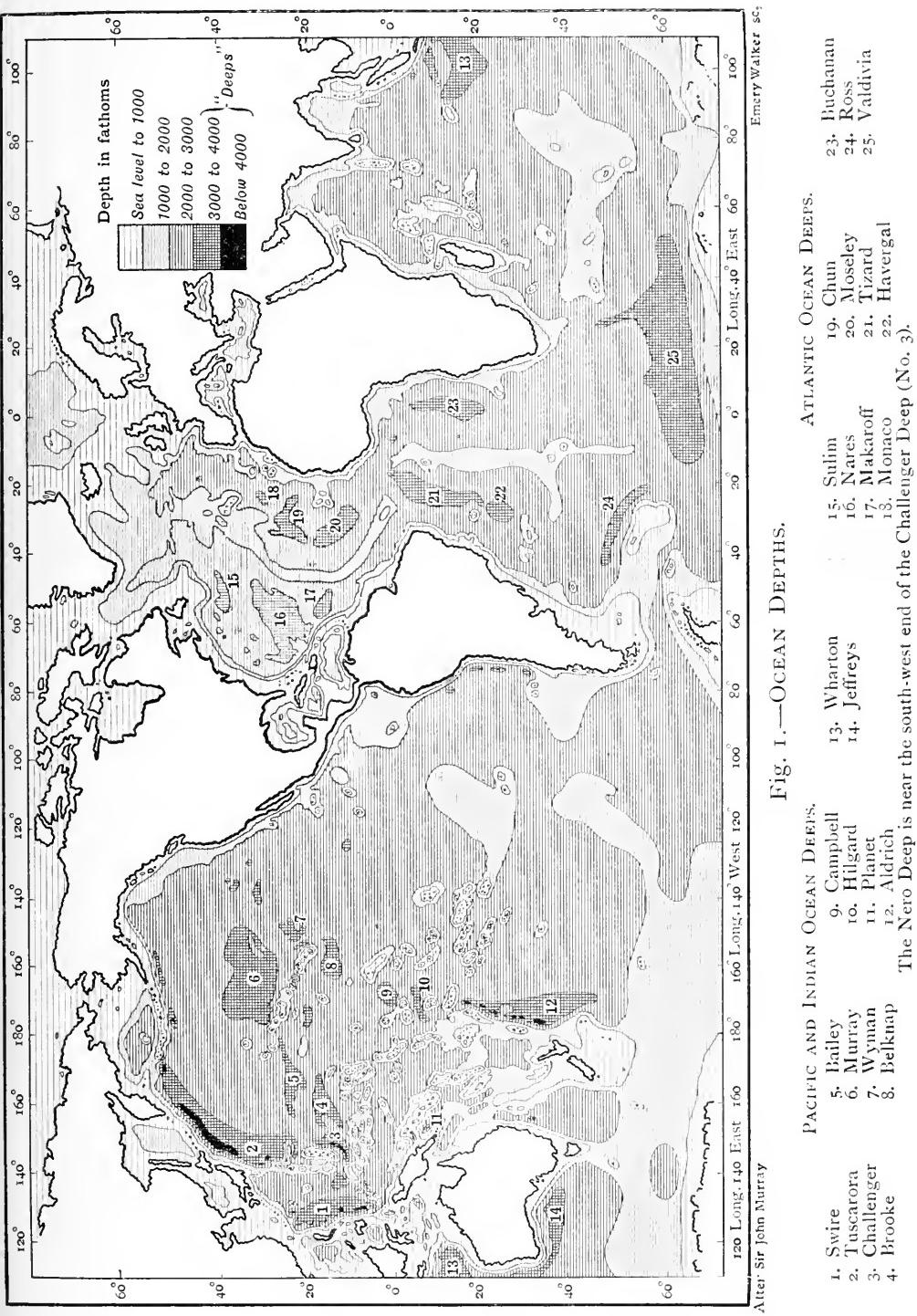


Fig. 1.—OCEAN DEPTHS.

PACIFIC AND INDIAN OCEAN DEEPS.

1. Swire
2. Tuscarora
3. Challenger
4. Brooke
5. Bailey
6. Murray
7. Wyman
8. Belknap
9. Campbell
10. Hilgard
11. Planet
12. Aldrich
13. Wharton
14. Jeffrey
15. Sulim
16. Nares
17. Makaroff
18. Monaco
19. Chun
20. Moseley
21. Tizard
22. Tizard
23. Buchanan
24. Ross
25. Valdivia

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increases much more rapidly to over 3000 fathoms, decreases to 1700 in mid-ocean, and then increases again to over 3000 before the West Indies are reached. Sufficient soundings have been taken to show that this is the case throughout the area included between lats. 50° N. and 40° S., and it is therefore inferred that a long ridge runs right along mid-Atlantic, roughly midway between the two shores, and with a deeper channel on either side. The ridge is known as the Dolphin Ridge in the northern and the Challenger Ridge in the southern Atlantic. A break has, however, been discovered in this ridge in the neighbourhood of the equator.

From the accompanying map and your atlas note the points at which this ridge reaches the surface to form islands. Notice the chief 'Deeps' of the Atlantic; the northern are apparently the deeper, soundings of 3875 fathoms having been obtained there.

The chief remaining phenomena of the oceans are so dependent upon the ocean winds that it will be necessary to understand these thoroughly before proceeding further.

Near the equator but, as we shall discover later, a little north of it, owing to the prevalence of land in the northern hemisphere, we find the line of maximum annual temperature.

What will the air here tend to do? Why should there be much rain and little wind in this part (known as the 'Doldrums')?

Air naturally flows in from north and south to take the place of the rising column thus formed, and, were the earth still, would take the form of constant northerly and southerly winds; but the direction of these winds is greatly modified by the rotation of the earth.

Which parts of the earth's surface travel most rapidly? which least?

If at any place on the earth's surface the atmosphere should travel at the same rate as the surface of the earth beneath it, the air would obviously appear quite still and no wind would blow. If for any reason the atmosphere should at any place move eastward faster than the earth there would be a westerly wind. Similarly if the surface of the earth should travel eastward faster than the air, the latter would be constantly dropping behind, *i.e.* there would be an easterly wind relatively to the people on the earth.

Compare the observed effect of two trains travelling in the same direction but at different rates. What does the slower one appear to be doing when watched from the faster?

We are now in a position to work out for ourselves what effect the rotation of the earth has upon these northerly and southerly intrushes of wind to equatorial regions.

How does the equator differ from the regions to the north and south as to its rate of travel from west to east? Will the winds flowing into the equatorial belt travel faster or slower than the belt toward which they flow? From which direction, therefore, will these northerly and southerly winds respectively come?

Illustrate these N.E. and S.E. winds by drawing a pencil line from top to bottom (*i.e.* N. to S.) on your exercise book, *at the same time* moving the book from left to right (*i.e.* W. to E.). What direction does the line take? Repeat the experiment, drawing the line upward to illustrate conditions in the southern hemisphere.

From the constancy with which these winds blow, they were named by early navigators 'trade winds' from a word meaning *constant* (*trade* originally meant a fixed course, or track). They blow with remarkable regularity between 30° N. lat. and 25° S., but vary in extent with the seasons, their zone being larger in the northern hemisphere

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from September to March, and in the southern from April to August. (See figs, 2, 3, and 4.)

What happens to the air at the equator and whence does the supply of air for these constant winds come?

Evidently to restore the equilibrium of the air there must be a circulation, and observations of the direction of movement of clouds and of volcanic dust show this to

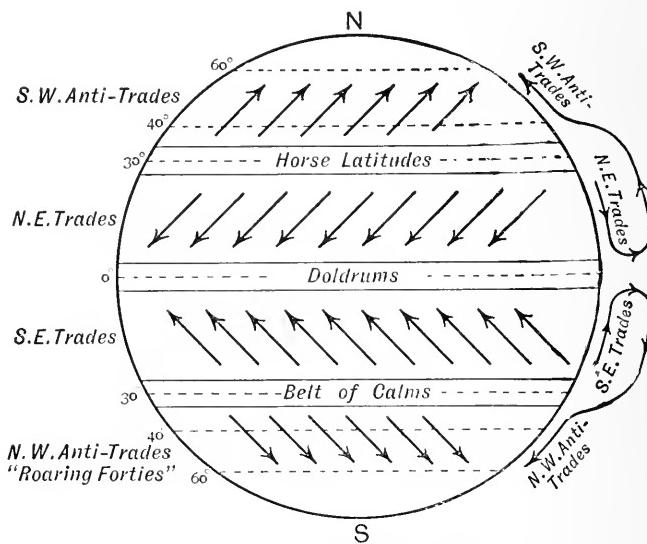


Fig. 2.—DIAGRAM OF WINDS.

be the case. When the rising column of air at the equator has reached the upper regions of the atmosphere, it moves back to the north and south from equatorial regions until it reaches about 30° N. and S. latitude respectively. By this time it has cooled considerably.

What will be the effect of this cooling (a) on its density, (b) on its vertical movement? What is the result of a downward moving column of air (a) on the barometer, (b) on the power of the air to hold moisture, and (c) on the weather with respect to clouds and rainfall? What type of weather would you suggest as fulfilling these conditions? Why are Madeira and the Canary Islands blessed with such perfect weather?

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As a matter of fact, as opposed to theory, this region of high pressure is rather the centre of an enormous anti-cyclone than a continuous belt of high pressure. This is especially the case in the northern hemisphere, and more especially in the summer months. The investigation of this is important, and will explain most of the facts as to winds in middle latitudes.

How does the northern differ from the southern Atlantic in the distribution of sea and land? Does sea or land exhibit greater changes of temperature?

The reason for the existence of a centre as opposed to the theory of a belt of high pressure is, then, the presence in North America and Asia of two centres of extreme cold and resulting high pressure during winter months, and of extreme heat and resulting low pressure in summer months, and these centres entirely destroy the continuity of this belt in that hemisphere. In the south this effect is only small, owing to the preponderance of sea over land.

Will the winds of these high-pressure regions blow inward or outward?

We have already dealt with the winds blowing toward the equator: let us now consider those blowing away from it.

What is the rate of rotation of the regions to which they blow as compared with that from which they come?

What is, then, the effect upon (a) winds from south to north, (b) winds from north to south?

To repeat our experiment with book and pencil, we must now move the paper from right to left.

These phenomena tend to be produced in all world-movements, and have been summarized in what is known as *Ferrol's Law*, which states that movements in the

northern hemisphere tend to deflection to the right hand of the direction of motion, and in the southern to the left.

To the north of the high-pressure area we therefore expect to find south-westerly winds in the northern and north-westerly in the southern hemispheres, and this is usually the case ; but as the high-pressure belt is more continuous in the south, so is the belt of ‘anti-trades,’ as they are called. So constant are they that sailors know the zone of 40° – 50° S. as ‘the Roaring Forties,’ or the region of the ‘Brave West Winds.’

Account for the prevailing south-westerly winds of Great Britain.

Which is the easier way to round ‘the Horn,’ the sailor’s phrase when speaking of the voyage round Cape Horn ? Why did Magellan find it such a hard task to pass through the straits named after him ?

To the north of the North Atlantic anti-cyclone is an area characterized by the almost constant low pressure recorded there. Its centre is close to Iceland, and it is certainly connected with the fact that the south-west winds coming from warmer latitudes bring a large amount of moisture evaporated from the ocean over which they have passed.

Where and when is the fall of temperature on travelling northward more extreme—on land or on sea ? in summer or in winter ?

It results that this area is very much larger in winter than in summer. The weather of our islands fluctuates according to whether they come under the influence of this Icelandic cyclone or the North Atlantic anti-cyclone. Notice that in either case the prevalent winds will be westerly (see figs. 3 and 4).

Sprinkle the surface of a vessel of water with some light powder (*e.g.* lycopodium, fine sawdust). Blow gently from a fixed position over the edge of the vessel. Notice the production

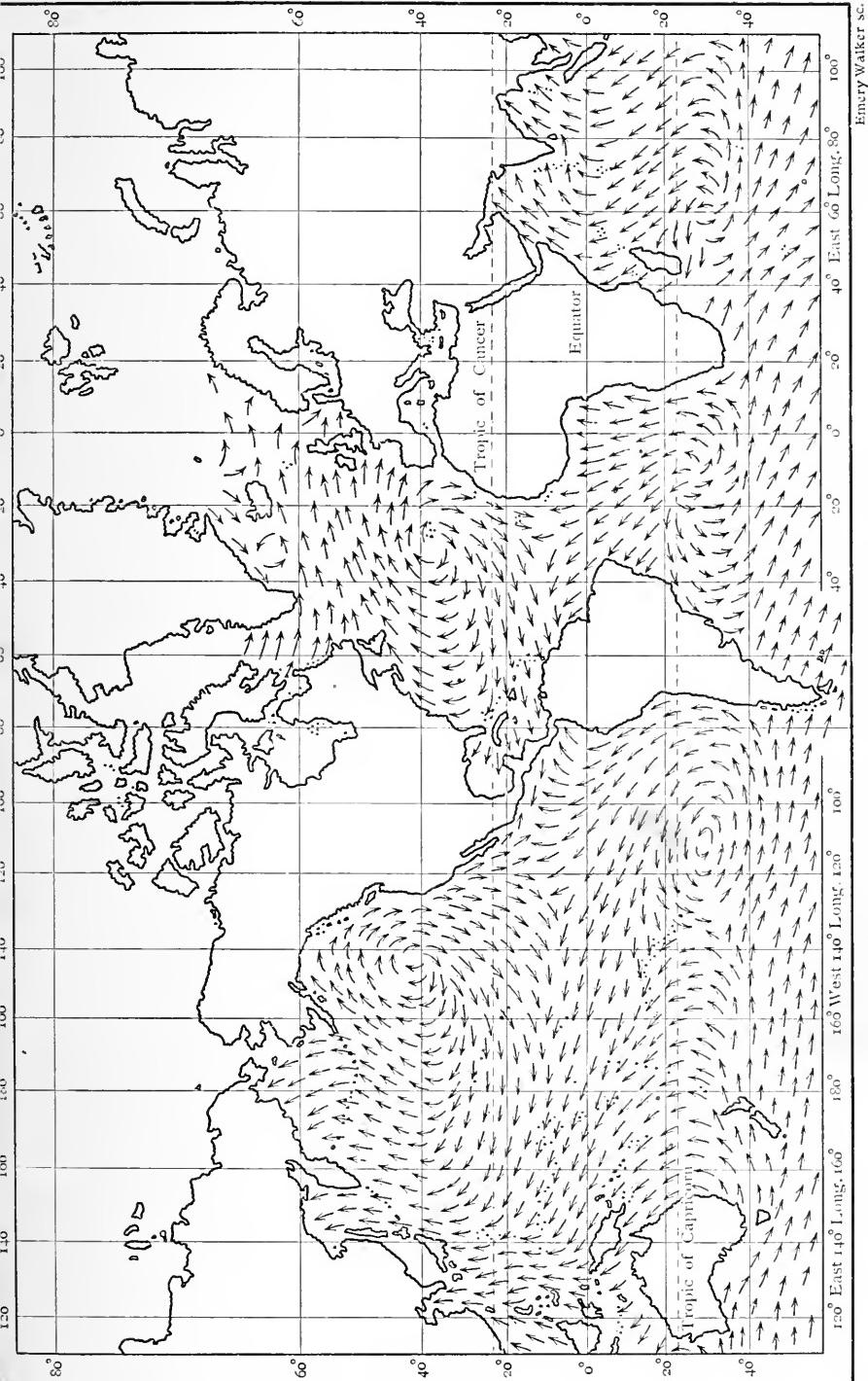


Fig. 3.—WINDS OF THE OCEANS. JULY.

What is the latitude of the heat equator in the Atlantic and Pacific respectively?
To discover this estimate the line along which the northerly and southerly trades meet.

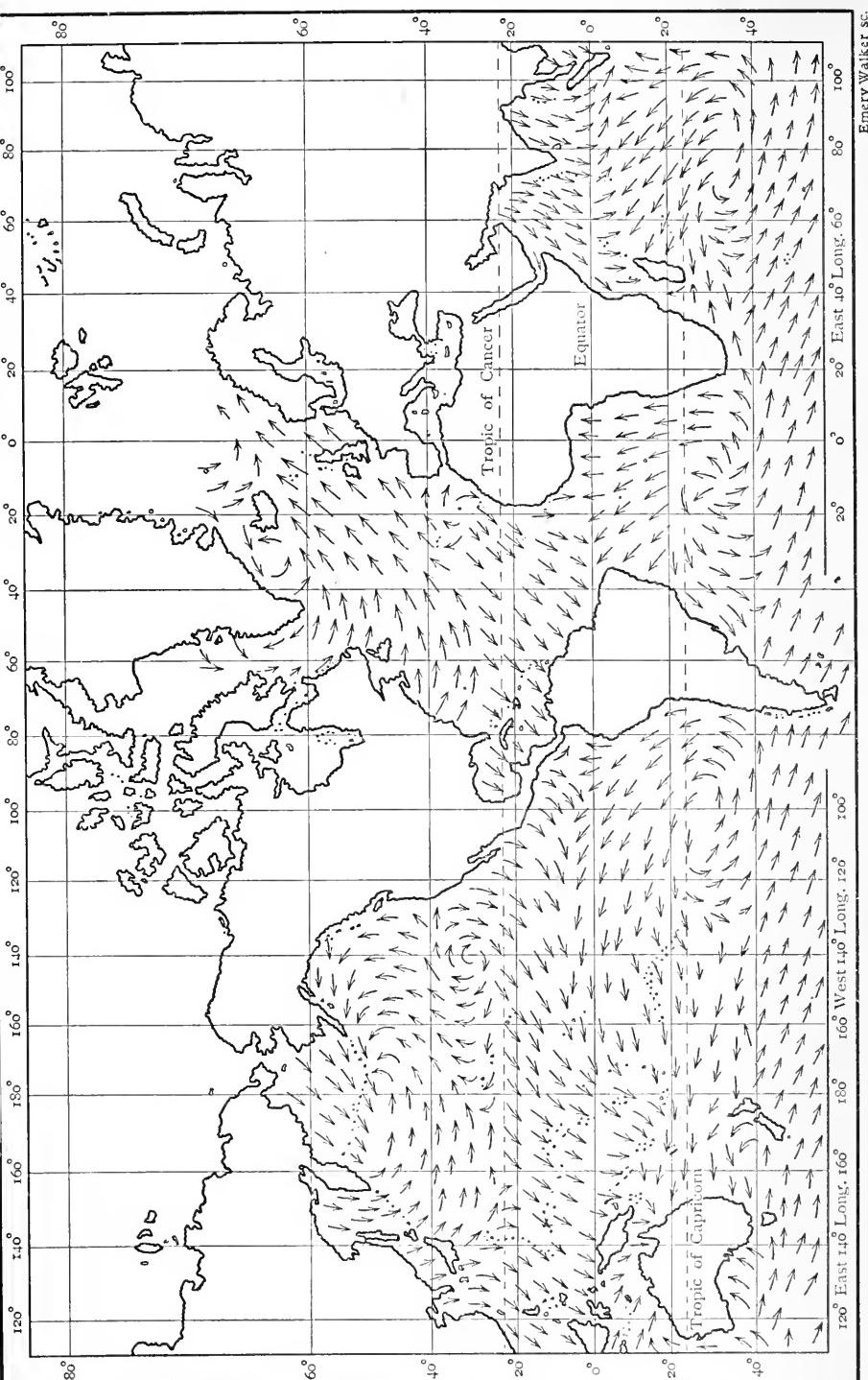


Fig. 4.—WINDS OF THE OCEANS. JANUARY.

What is the latitude of the heat equator in the Atlantic and Pacific respectively?

Compare with the July chart and suggest a reason why the Atlantic heat equator (see p. 22) shifts more with the seasons than that of the Pacific.

Consider which is the wider ocean, and the moderating effect of the oceans on climate.

of regular currents on the surface of the water. Blow steadily across the middle of the vessel and note the return currents on either side.

Ocean currents, *i.e.* more or less permanent and regular movements of the surface water, are produced chiefly by the winds above mentioned. Other causes are differences in the temperature and salinity (= saltiness) of different parts of the ocean, but these have not much effect upon *surface* currents.

Which are the most permanent winds of the Atlantic?

These naturally produce the chief currents, and as a result we find a steady movement of equatorial waters from the coast of Africa to that of America, known as the Great Equatorial Currents. Between them in the Doldrums is a slight counter-current. The South Equatorial Current reaches South America just where it juts furthest eastward at Cape San Roque, and by that cape is divided into two parts. The southern part flows southward along the coast, but is met by a cold current from the Antarctic. In accordance with Ferrol's Law it turns to the left and a cold current separates it from the Argentine coast. Continuing its course to the left, it crosses the South Atlantic, reaches South Africa, and flows northward as the Benguela Current to the Gulf of Guinea, where it meets once more the equatorial waters, and joining the South Equatorial Current completes a huge vortex of slowly circling surface water moving at a rate ranging from 1 to 120 miles per day. Its pace naturally varies according to the strength and constancy of the winds. The northern part of this South Equatorial Current and the whole of the North Equatorial form a similar vortex in the North Atlantic, which, however, is far more complex, owing to (a) the greater amount of water, (b) the West

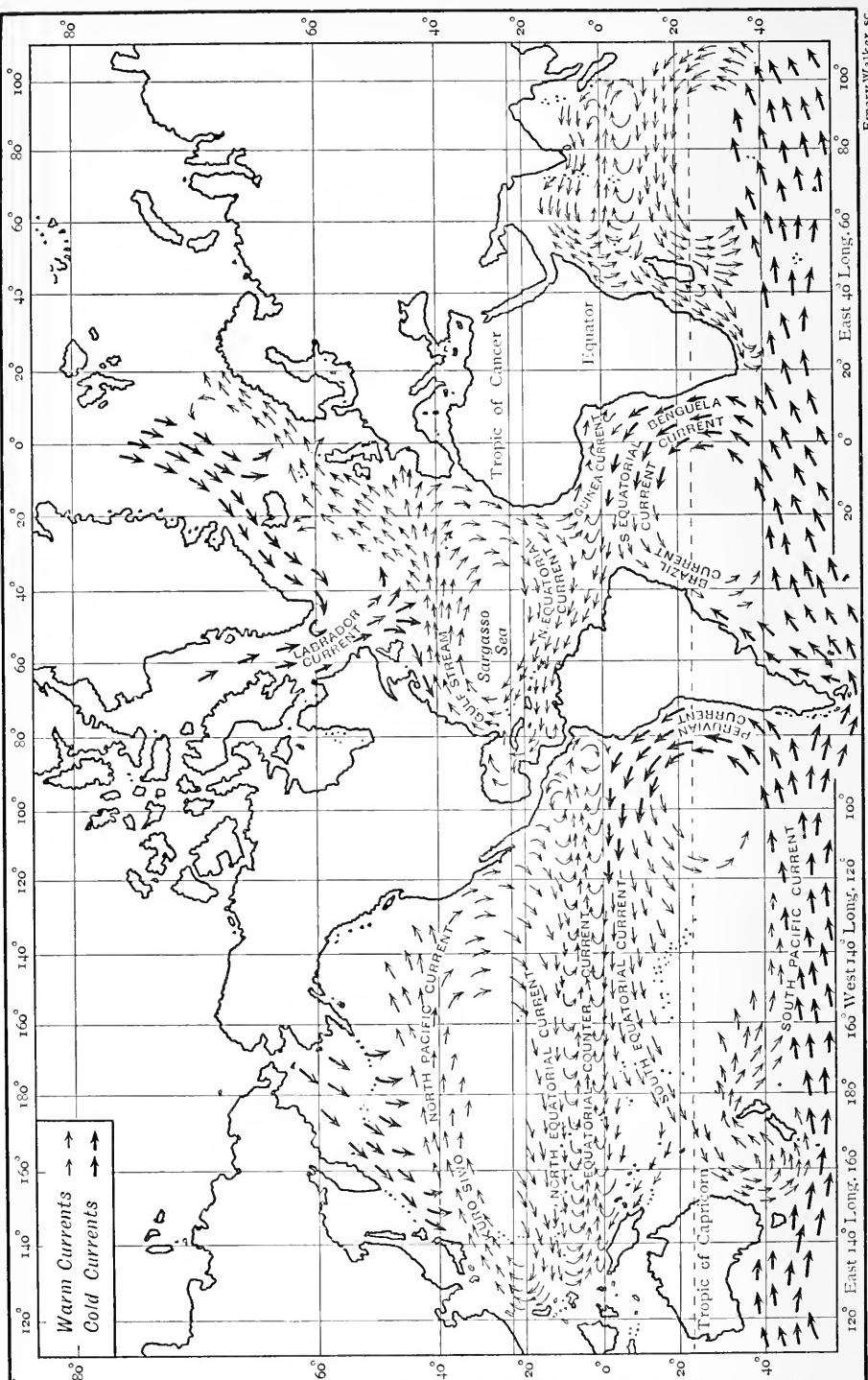


Fig. 5.—OCEAN CURRENTS.

Compare this map carefully with figs. 3 and 4 and note how each current is affected by the direction of the prevailing wind.
Name countries or areas greatly affected by warm or cold currents respectively.

Emery Walker Sc.

Indian Islands and the Gulf of Mexico, and (c) the nearly land-locked northern border.

The pressure exerted by these two great currents on entering the Gulf of Mexico causes a return current, known as the Gulf Stream, to flow out south of Florida. This current has most remarkable characteristics, being comparatively swift, warm, and salt, and it flows almost like a river in the surrounding ocean, though of course it gradually loses these characteristics and is indistinguishable from its surroundings by the time it passes Newfoundland. It is separated from the coast of America by a cold current from the Arctic, which, however, is much more marked than that to which we referred in the South Atlantic. This cold current exerts considerable influence on the climate of North America, especially Labrador, and is consequently called the Labrador current. Part of the Gulf Stream passes across the Atlantic, and with the Northern African Equatorial Current forms a complete rotation of the waters of the North Atlantic Ocean, at the centre of which is a region called the Sargasso Sea, from the large mass of weed (*Sargassum*) floating in its non-drifting waters.

The bulk of the Gulf Stream, getting ever and ever slower till it is no more than a drift, and is so called, passes northward up the Atlantic Ocean past the British Isles to Europe.

Consider the distribution of land and sea in the northern border of the Atlantic; compare it with that of the southern. Account for the absence of a strong Arctic drift, and thus also for the northerly extension of the Gulf Stream drift.

How does the Gulf Stream drift, accompanied as it is by prevailing south-westerly winds, affect the climates of Great Britain and Iceland (a) as regards temperature, (b) as regards moisture?

How do you connect the fogs off Newfoundland with the Labrador Current and the Gulf Stream respectively?

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In which part of the North Atlantic do icebergs travel farthest south ? Why ? How does this have to be taken into account in navigation ? and at which season of the year ? Can you account for the fact that icebergs sometimes drift against the direction of the Gulf Stream ? (Fig. 6).

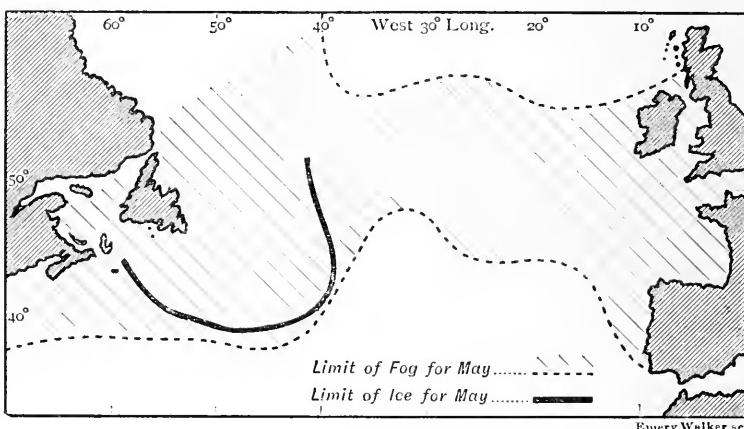


Fig. 6.—ICEBERG LIMIT, NORTH ATLANTIC.

Compare carefully with fig. 5 and explain the position of the ice limit. Why does it reach so far south on the western border of the ocean, and yet not even reach Britain on the eastern side ?

The exact positions of the great wind belts are of course liable to variation during the course of the year.

When is the sun vertical over (a) the equator ? (b) the tropic of Cancer ? (c) the tropic of Capricorn ? Look at figs. 3 and 4 and note the position of the Doldrums at the extreme seasons. To what extent do they vary ?

It is thus seen that in the Atlantic the position of the Doldrums, which we may mark roughly as the 'heat equator' or region of maximum heating, though it varies during the year, always lies to the north of the equator.

Study the map and observe the relative position of land and sea north and south of the equator respectively. In which does the land predominate ? What is the effect of large masses of land (a) upon climate generally, (b) upon a hot tropical climate ? Why, therefore, do the Doldrums always lie north of the equator ?

To similar considerations is due the comparatively small variation of the position of the ocean winds except near the heat equator. Such variations, however, as do occur are sometimes accompanied, especially in these tropical regions, by variations in the ocean currents themselves. One of the most noteworthy incidents of this is to be found in the Pacific Ocean, to a study of which we shall now turn.

Study a map of the Pacific Ocean. Name the continents which border on this ocean. Compare it with the Atlantic Ocean as regards :

- (1) the greatest length N. and S ;
- (2) the average width E. and W ;
- (3) area ;
- (4) the number of islands.

What effect has the position of the American mountains on the area of the land draining into the Pacific and that draining into the Atlantic ?

Name the largest Asiatic rivers draining into the Pacific.

Study carefully the coast-line of Eastern Asia. What do you notice as regards the number of seas ? How are they separated from the open ocean ? Name the largest of these seas. What is the nature of the islands separating these seas from the open ocean ?

From the above map-study we observe that the Pacific Ocean forms by far the largest stretch of water on the face of the earth. Not one large river flows into the open ocean, which is bounded on three sides by mountains and rocky mountainous islands, the water of the large East Asian rivers flowing into the narrow seas, which are cut off from the main ocean by festoons of islands. Thus, although the Pacific is nearly twice the area of the Atlantic, it drains but little more than a quarter of the area of land drained by the latter.

A comparison of the oceans in fig. 1 shows that the average depth of the Pacific is greater than that of the

THE HOME OF MAN

Atlantic and that it also contains the deepest waters as yet fathomed. The greater part of the ocean consists of an enormous basin, in which most of the water has a depth of over 2500 fathoms. The basin stretches to the shores of the mainland, or to the islands near the mainland, except in the region of South America, where on a ridge known as the Enterprise or Easter Divide the water has a depth of less than 1000 fathoms. Nearer the land the sea deepens again, only a very narrow continental shelf separating the deep water from the land.

In some parts of the basin the bed rises very steeply, giving rise to mountainous islands or low-lying coral reefs ; in others the depth increases rapidly, forming depressions called according to their shape either troughs or basins.

Find on the map the chief, namely the largest and the deepest, depressions.

What do you notice in each case as to the position of the nearest islands ?

The greatest ocean depth yet measured is 5269 fathoms in the Nero Deep, near the Ladrone Islands.

Compare this with the height of Mount Everest, 29,002 feet, the highest mountain in the world.

It is because the majority of the islands of the Pacific are volcanic that their coasts fall away very rapidly below the sea, so much so in some cases that soundings of over 2000 fathoms have been taken between two islands quite close to one another.

They fall into certain well-defined divisions.

(1) The chain of islands fringing the eastern coast of Asia.

(2) The Malay Archipelago.

(3) Australia, New Guinea, Tasmania, and New Zealand.

DEPTHES WINDS AND CURRENTS 25

(4) The numerous groups of small islands to the east and north-east of Australia.

Find the three groups of small islands on the map, *e.g.* Micronesia (small islands), Melanesia (black islands), Polynesia (many islands). Name some of the smaller groups composing these.

How does the American side of the Pacific compare with the Asiatic

(a) as regards depth, (b) as regards the number of islands?

Name some of the islands and groups of islands off the American coast.

Look at figs. 3 and 4, and, ignoring for the moment local variations of wind near the continental margins of the oceans, compare the great ocean winds of the Pacific with those of the Atlantic. What do you observe?

As the currents of the ocean are so dependent on the prevailing ocean winds, we are not surprised, on comparing the circulation of the waters of the two oceans, that a marked similarity again prevails (see fig. 5). As in the Atlantic, the waters move in two opposed circular movements, north and south of the equator respectively. Thus are produced travelling toward Asia two equatorial currents, the southern of which provides the East Australian Current. The northern, on the other hand, pursues a course very similar to the Gulf Stream, passing between the islands of Japan and the mainland. This warm current, known as the Kuro Siwo, or Black Current, because of its deep blue colour, is similar in most respects to the Gulf Stream and one branch of it travels west to the American coast, where it turns south to complete the northern circuit.

Note the compensating counter-current between the north and South Equatorial Currents.

Along the coasts of Mexico and Central America flows a current the direction of which varies with the season. During the northern winter its course is south-east, whilst during the remainder of the year it is reversed.

THE HOME OF MAN

Compare fig. 1 with figs. 4 and 5, and show how this is at least partly due to a change in the prevailing winds.

As in the Atlantic Ocean, a flow of cold water from polar regions takes place mainly on the west in the north and on the east in the south. Thus, Northern Asia is subject to a cooling influence similar to that of the Labrador Current of the North Atlantic, and the Peruvian or Humboldt Current has a marked effect on the climate of the west coast of South America.

In studying the climates of Asia and South America, note the influence of these cold currents upon the isotherms, especially in winter (see fig. 14, Asia, and fig. 19, America).

Account for the fogs of the north-west and south-east margins of the ocean.

Having regard to what you have learned as to rotation of air and water in the northern and southern hemispheres respectively, suggest an explanation of why the main cold currents from polar regions come into the oceans on the west side in the northern hemisphere and on the east in the southern. On which side in each hemisphere do the warmer waters drift back to the polar regions?

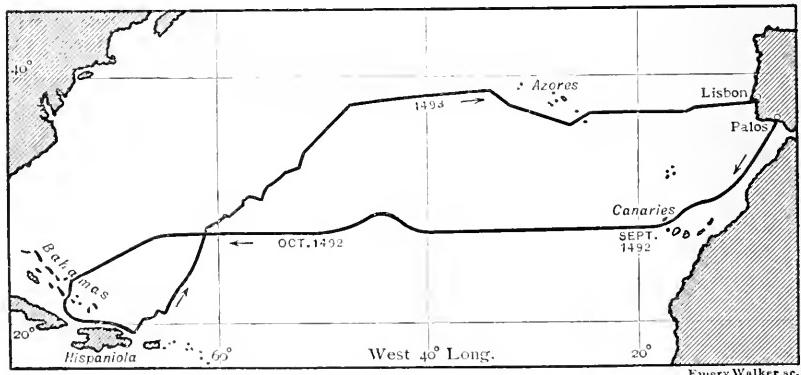


Fig. 7.—MAP OF THE ROUTE TAKEN BY COLUMBUS.

EXERCISES AND QUESTIONS

- (1) Study carefully figs. 3, 4, and 7 and explain, firstly, why America remained so long undiscovered by Europeans; then discuss the

DEPTH WINDS AND CURRENTS 27

reason for the route taken by Columbus, both on his outward and return journeys. Could he have improved upon it?

- (2) Roughly trace the map showing the currents in (a) the Atlantic, or (b) the Pacific Ocean, mark on this the direction of the permanent winds, and show how far the direction of the winds and currents agree with one another.
- (3) Make an elevation of Atlantic depths (fig. 1) (a) from Washington to Lisbon, (b) along the tropic of Capricorn, and compare these with elevations of Pacific depths along latitude 40° N. and along the equator.

Use a horizontal scale three or four times that of the map, and a vertical scale 1 inch = 3000 fathoms. Determine approximately the exaggeration of the vertical scale. Note that this graph must be constructed from above downwards, the horizontal or sea-level line being along the top of the diagram.

CHAPTER II

THE STRUCTURE OF NORTH AMERICA

REVISION MAP STUDY

What is the shape of North America? What is its extreme northern latitude? What is the latitude of the southern boundary of



Fig. 8.—TIME ZONES, UNITED STATES AND SOUTHERN CANADA.

Why is Eastern time five hours earlier than Greenwich mean time? To what longitude does it correspond? Each of the other zones is an hour earlier or later than the neighbouring zones. What is the time at San Francisco when it is midnight at New York? The irregularity of the boundary lines between the zones is due to railway and State considerations. Account for the influence of railways in determining the boundaries. To which of these belts is the name 'Prairie time' sometimes given?

Mexico? What is the length of the whole continent of America (N. and S.)? How does it compare with the length (N. to S.) of Africa and the breadth (W. to E.) of Asia? What is the greatest breadth (due E. and W.) of North America? In what latitude does it lie? How does it compare in position and extent with

STRUCTURE OF NORTH AMERICA 29

the greatest breadth of the Old World? Why is this comparison of great economic importance? In answering this, consider which regions of the world have the most suitable climate for man. What is the position of the equator relative (a) to the two parts of the American continent, (b) to the bulk of South America, (c) to the bulk of Eurasia, (d) to Africa? What are, respectively, the extreme eastern and western longitudes of North America? What range of time does the difference represent (see fig. 8)? What is the difference of time between New York and London? Name the chief mountain ranges of North America; how do they lie relatively (a) to the coast, (b) to one another? Name the chief rivers flowing to each ocean or sea. Where does each great river have its source?

We thus see that the North American continent consists roughly of three distinct regions; firstly a western *cordillera*—a high mountain region of vast extent, running the whole length of the continent from north to south and in places some 1000 miles wide; secondly an eastern mountain region of much more moderate elevation, including the plateau of Greenland and Labrador, the Laurentian (St Lawrence) Highland of Eastern Canada, and the Appalachian Mountains and Alleghanies of the United States; thirdly, a vast plain, or series of plains, between these more or less coastal uplands, extending, as do the mountains on either side, the whole length of the continent from the Arctic Ocean to the Gulf of Mexico.

Look at the contour map and observe the positions of these three regions. Observe the comparatively narrow strip connecting the northern and Canadian section of the plain with the United States section.

Thus it is seen that in this region the divide between the Canadian river system flowing north and east and that of the States flowing south is less than 1000 feet high. As a matter of fact it is less than 800 feet.

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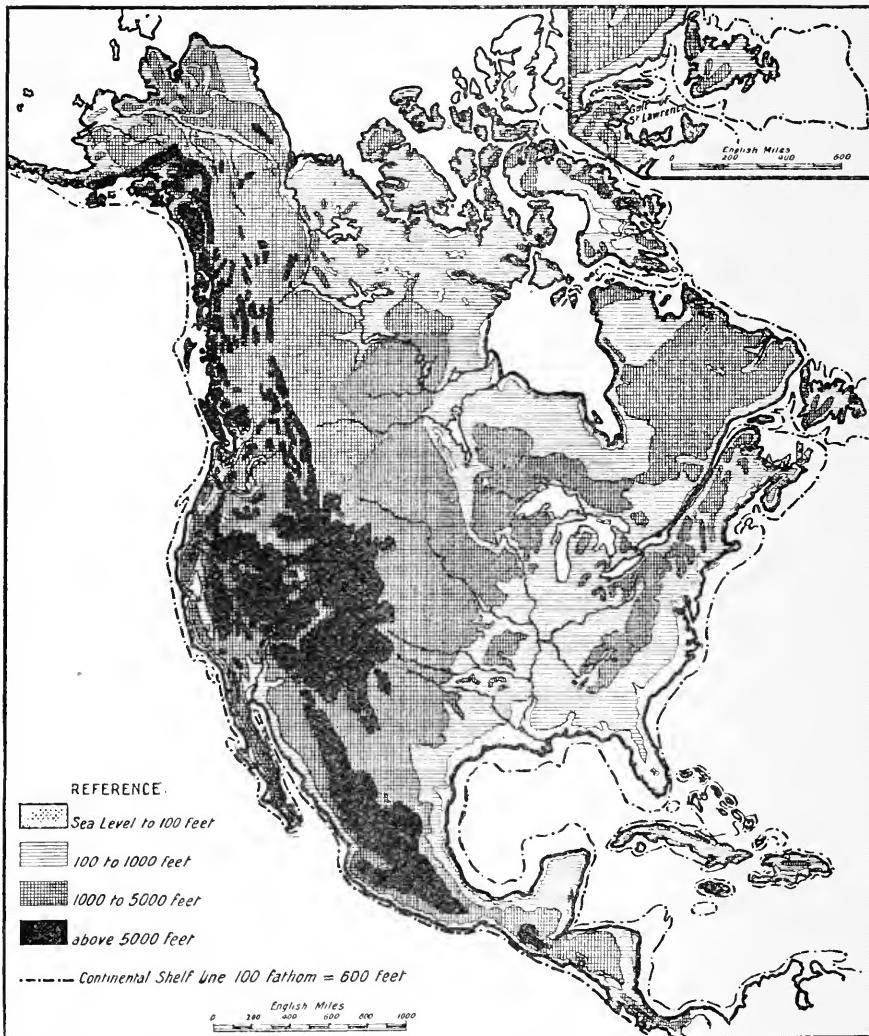


Fig. 9.—CONTOUR MAP OF NORTH AMERICA. MOUTH OF THE ST LAWRENCE INSET.

Observe the position of the 100-fathom line all round the coast, especially in the mouth of the St Lawrence and round Newfoundland. Why is its position in the former instance of such importance to navigation? In the latter case how does its position affect the fishing industry of the island?

Name the two great rivers on each side of this divide region. Into which river basin and sea does each flow? What sort of a profile or regimen would you expect each to have? Notice, too,

on a large scale map that the north-flowing river forms the large Lake Winnipeg. Observe also the marked difference in character between the eastern uplands and the western Cordilleras.

This difference in structure is accompanied by corresponding differences in origin and geological history. The Laurentian plateau, the Appalachians, and Alleghanies are alike in being some of the most ancient and at the same time most denuded highlands of North America. In this way they resemble the ancient block mountains of Europe. The analogy with the European mountains, however, can be carried further.

What do you recall as to the position of the European coalfields relative to the Cevennes, the Ardennes, the slate mountains of the Rhine, the ore mountains, etc. ?

So also round these more ancient eastern mountains of the North American continent are situated the main coalfields, as well as the oilfields of the continent (see figs. 9 and 10).

Again, the Laurentian highlands, the most northern on the Atlantic border, resemble the Scandinavian heights of Europe—also on the Atlantic border—in having maintained to a considerable extent their present formation since very early geological periods. In each case this is owing partly to long periods of complete glaciation (see fig. 14).

Nor does the analogy between America and Eurasia end here, for though the great American plain runs north and south instead of east and west, the vast mountain mass of the Rockies forming its western border instead of a southern border as in the great Asiatic plateau, each continent is possessed of a warm mediterranean sea which has foundered and provided itself with a margin of folded mountains. In the case of the Gulf of Mexico and the

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Caribbean Sea, however, these mountains appear now merely as a ring of islands on its eastern and northern borders. Compare with this the origin of the Balearic Islands.

Which are the folded mountains that were formed along with the foundering of the Mediterranean basin in Europe? How do they lie relatively to the sea?

Compare the great plains of Europe with those of North America.

Which European plain stretches from an inland sea in the south to Arctic regions? In which direction does the main drainage flow?

Compare also the regions of inland drainage of Eastern Europe and of Asia with the Great Basin—the area of inland drainage in the Rocky Mountains (Utah Salt Lake). In what respects does its position differ greatly from that of the Caspian?

Finally, the great Cordillera with its different ranges is geologically the most recent of all the uplands of the continent, there being in some regions a depth of some 50,000 feet of stratified rock.

Explain how this fact gives unmistakable evidence of the youth of these mountain ranges.

On the other hand there has been much volcanic activity, especially on the Pacific border, though both coasts give evidence of repeated rise and fall. Submergence of the whole of the coast-line is plainly shown in the extent of the continental shelf shown in fig. 9, the outline of which on the Atlantic coast roughly corresponds to a 100-fathom contour with a steep slope on the seaward side to a depth of 2000 fathoms or more. Soundings on this coast have shown that at the mouths of all the large rivers on the east coast deep channels in the floor of this continental shelf pass right out to its very edge. In the case of the Hudson this submerged river valley has been traced over 100 miles seaward to the edge of the continental shelf, while the valley of the St. Lawrence has

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been similarly found to pass some 200 miles to the east of Nova Scotia (fig. 9 inset).

In what respects are these facts of great commercial importance?

Consider this question especially with regard to the Hudson River, Susquehanna, and St. Lawrence. Name in each case a city that has grown up on the estuary thus formed. On a larger scale map observe the different effect of the drowning of the coastal plain on the low eastern and steep western slopes respectively. On which coast has the greater number of islands (close to the shore) been formed by submergence?

EXERCISES AND QUESTIONS

Construct a profile (regimen) for each of the rivers given in the following table. Determine vertical and horizontal scales to suit a page of your exercise book and state approximately the extent of exaggeration of the vertical scale.

	Dis-tance from Mouth Miles	Height above Sea-level		
		Missouri- Mississip-pi	St Law-ren-ce	Green- Colorado
Idaho-Montana boundary	4200	8600	..	..
	4000	3200	..	..
	3500	2300	..	..
	3000	2000	..	..
	2500	1100	..	..
Sioux City	(approx.) ¹	2100	1000 ¹	..
		2000	900	1400
Entrance to Lake Superior ²	1915	..	600 ²	12,000
	1600	..	..	6000
	1500	600	600	5250
Entrance to Lake Huron	.	..	580	..
Junction of Missouri ³	1300	500 ³	..	..
Junction of Green-Colorado ⁴	1080	..	..	3800 ⁴
	1000	300	580	3500
Lake Erie ⁵	.	900	573 ⁵	3400
Lake Ontario	.	870	247	2600
		700	..	1800
		650	247	..
		500	Sea-level (estuary)	900
		..	Sea-level	Sea-level

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- (1) Draw these profiles on the same diagram using a horizontal scale of 1 inch = 1000 miles and a vertical scale of 1 inch = 2500 ft. What is roughly the exaggeration of the vertical scale? Compare the rivers together and explain by reference to the map the differences thus shown between them. Which has the most even course? Which the least? Note the position of Niagara Falls on the profile of the St Lawrence. What is the average rate of fall between Erie and Ontario? To which of these rivers are the Rhone, the Volga, and the Rhine respectively similar?
- (2) Draw an elevation E. and W. through Canada and the United States respectively. For the horizontal scale double that of the map and for the vertical scale take 1 inch = 2000 ft. What is the approximate exaggeration of the vertical scale?
- (3) Compare with the contour map the railway maps, figs. 9 and 40 on pp. 30 and 77. Note how the difficulties of crossing the Rockies have been overcome in each case.
- (4) Draw a large scale sketch map of the Western Cordilleras copying in from an atlas the position of the following chief groups. The Chilcat Mountains (St. Elias Alps), Cascade Mountains. Coast ranges: Sierra Nevada, the Wasatch Mountains, the Sierra Madre. The Gold and Cariboo Mountains, and the Selkirk and Purcell ranges. Mark on the same map the Mexican, Colorado, and Columbia plateaux and the Great Basin, also Mount Rainier (15,500 ft.), Mount Shasta (14,350 ft.). Note also Mount Dawson (over 11,000 ft.) on the Selkirks.
- (5) In a small sketch map show the relative position of the following mountain groups, the Cordilleras, the Black Hills, the Ouachita, the Ozark, the Appalachians, and Alleghanies, the Laurentian Plateau.

The outlines for sketch maps should be traced from the atlas on the book.

CHAPTER III

THE GEOLOGY OF NORTH AMERICA

THE geological history of the North American continent has been so varied and the resulting structures so complicated that to give anything approaching to an adequate account of it would involve us in a very detailed study of geology. It must, therefore, suffice to deal only with such main features in the past history of the continent as influence its present suitability or adaptability as a home for man.

We have already referred to the Laurentian Highlands and the Appalachians as being some of the most ancient mountain blocks of the continent, and to a certain extent testimony to this fact is afforded by a study of a map of the district. (Fig. 11.)

In what direction do the main valleys run? Name from the map the chief rivers draining this region. In what direction do the Delaware, Susquehanna, and Potomac each flow relatively to the chief valleys?

We thus see that each of these rivers has formed what is known as a water-gap through the mountain ridges. (Fig. 12.)

What does this suggest as to the original land level between the ridges?

Geological investigation, moreover, has shown that these top ridges are all that is left of an originally almost level plain, itself the result of a long period of erosion and denudation. Such eroded plains, because of their

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occasional less denuded ridges or mounds of more resistant rock, are called *peneplains* (*almost plains*). This

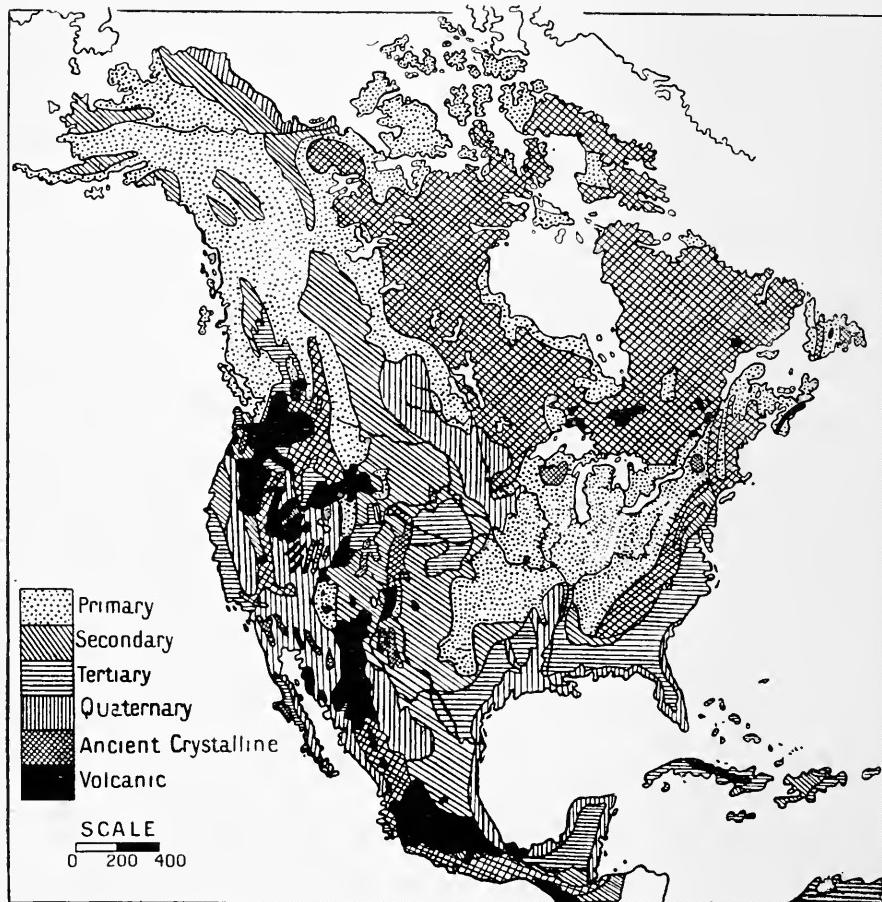


Fig. 10.—ROUGH GEOLOGICAL MAP OF NORTH AMERICA.

Compare the above carefully with figs. 38 and 39. To which geological period is the formation of coal (Anthracite and Bituminous) to be especially assigned? What generally is the nature of Tertiary coal? Also compare with figs. 37 and 42. Note any connection between the distribution of the minerals and (a) the different geological periods; (b) the coal regions; (c) the recent volcanic regions; (d) the ancient crystalline rocks.

plain seems to have undergone a slow upheaval which caused an eastward drainage of its waters, so slow indeed

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as to allow the rivers draining it to cut down through the resistant ridges. The tributaries of the three rivers have, moreover, cut away into the less resistant rocks

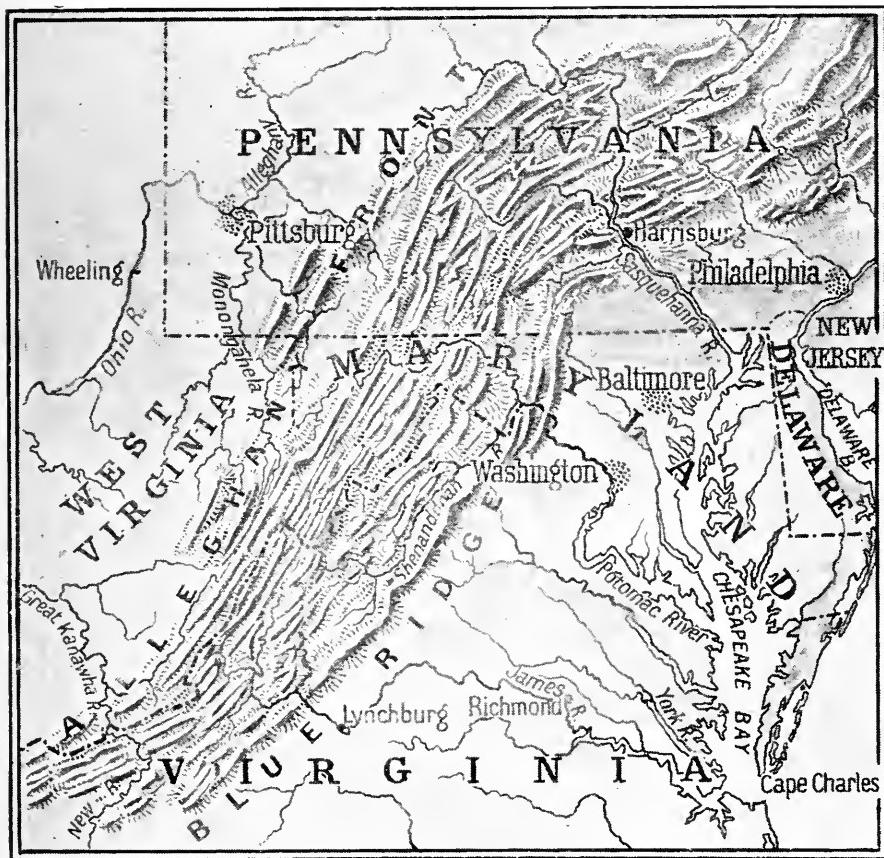


Fig. II.—THE ALLEGHANY MOUNTAINS.

Name all the east flowing rivers. Which of them have cut water-gaps? A glance at fig. 40 will show that these water-gaps have been of great importance in railway development.

between, and have thus carved out a series of alternating valleys and hills parallel to one another, but at right angles to the main rivers.

This may be readily illustrated by a rough model in plasticine or in modelling clay.

Between these ancient eastern mountains with their long history of erosion and denudation, and the vast, but much more recent Cordilleras lies the great American plain with a comparatively uneventful geological record. Most of the strata are horizontal and evenly disposed one upon the other, and give evidence of having been formed largely on the floor of a shallow sea. The most valuable



Fig. 12.—DELAWARE WATER-GAP.

Note its position on the Map (fig. 11).

strata are, of course, the coal measures, which are found in great abundance in a broad band stretching from the eastern mountains to the Cordilleras. Though coal has not been worked, or found in workable seams over the whole plain, it would seem that at various periods the entire surface has been occupied by those marshy growths essential for the production of coal.

How does this agree with the suggestion that the vast central sea was a shallow one? How does the formation of coal measures

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usually suggest repeated sinking and upheaval? What has become of the coal measures that originally lay on the eastern mountains? Why is the coal more easily mined near the edges and foot of these hills than further away in the plains? Give an instance of similar conditions in Britain, or in continental Europe. (See figs. 38 and 39.)

Whilst most of the coal is the ordinary bituminous variety, there are some extensive beds of anthracite, especially in Pennsylvania, and in many districts quantities of lignite are found, some of comparatively recent tertiary formation.

Recall the differences between these kinds of coal. Find the towns of Wilkes, Barre and Scranton, important mining centres for anthracite in Pennsylvania.

In no part of the world are there to be found more varied supplies of fuel than in North America, for besides these well distributed coalfields the same Pennsylvanian region contains the richest oilfields in the world.

Why should these be in the same districts as the coalfields? Remember that petroleum contains the same chemical elements as coal. Which are these?

In some places the oil is at such a pressure in the shale containing it that, like water in an artesian well, it rushes up through the boring made down to it. In other regions it requires to be pumped up.

Show by a diagram how this may be due to a reason similar to that which governs the working of an artesian well (provided that the oil-bearing shale lies between strata that are impervious to it).

In some cases, however, it is due to the great pressure generated in the oil beds by the large quantities of natural gas given off by the shale. This natural gas, which resembles marsh gas, in that it is produced by the decay

of animal and vegetable remains in marshes is sometimes collected and made use of for heating, and lighting, and for industrial purposes.

Other oil yielding regions are Colorado, Wyoming, Ontario, and California.

Note on the map (fig. 39) the position of Buffalo, one of the many

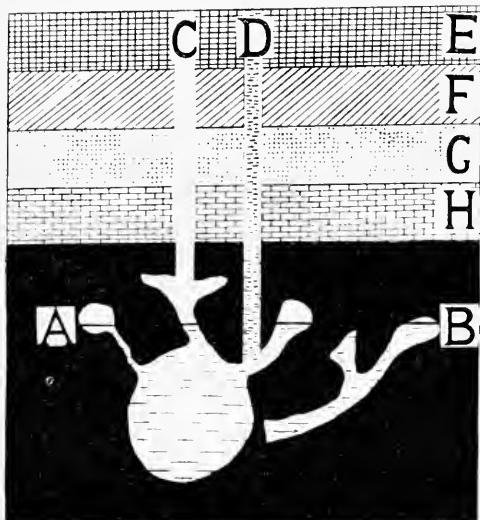


Fig. 13.—DIAGRAM TO ILLUSTRATE OIL BORINGS.

This is absolutely diagrammatic as the oil does not lie in pockets but runs in cracks and fissures as shown at B.

A and B = oil level. E, F, G, H, overlying strata. C is a boring that happens to tap a collection of gas. D , , , , taps oil.

States. The North-Western territories possess very large, though much broken and uneven, deposits, corresponding to those in the western States. The vast coalfields underlying the western plains are as yet comparatively undeveloped, but in the extreme west in British Columbia, very rich deposits of coal of all kinds are worked, both on the mainland and on the various islands.

of Buffalo, one of the many cities where the houses are illuminated by natural gas; also the positions of Bradford and Oil City in Pennsylvania, of Olean in New York, Petrolia in Ontario. All these are great oil centres.

Estimate the length of pipe used, respectively, to carry oil from Bradford (a) to the Atlantic, (b) to the St Lawrence Lakes.

Canada, too, is well supplied with fuel. It has several coalfields; the richest is found in Nova Scotia and C. Breton Is., a northern and most important continuation of the coalfields of the Eastern United

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Nothing has so aided the rapid development of the United States, or promises so well for the future development of Canada as the fact that throughout North America rich iron deposits are closely associated with the great coalfields. The richest of all iron ores—magnetite—occurs most abundantly in the Appalachian region, also on the southern shores of Lake Superior, in Eastern Canada and in Texas. Black band ore is found in immediate association with coal in Pennsylvania.

Why is the black band ore, though not so rich in iron as magnetite, comparatively easy to smelt? In which coalfield of Britain is this ore mined and smelted?

Study figs. 37 and 38, and note the position of these coalfields and iron deposits.

The red iron ore known as haematite, is found in the Lake Superior region, namely in Michigan, Minnesota, and Wisconsin, as also in the Ozark Hills.

In which iron district of Britain is haematite mined?

In another respect the great coal and iron regions of the Alleghanies are placed at a great advantage—namely, that in the same region there are found ample supplies of limestone.

Explain this.

On the other hand, the nearness of the Michigan and Wisconsin deposits to the great lakes to a certain extent compensates for the absence in those regions of both fuel and limestone.

Explain how this is so. Note the position of Duluth, Superior, and Marquette, the chief ports in the iron ore trade.

The ore deposits of Ontario are not as yet by any means worked to their fullest extent, even though oil fuel is at hand and coal can be imported across the lake.

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The great mining district of Michigan is by no means dependent solely on its production of iron ore, for there are also present large quantities of copper, consisting in this instance of native metal. The continuation of the Laurentian Highlands in Ontario also contains excellent supplies of copper.

What is meant by a native metal as distinguished from a metal ore ?

A glance at figs. 37, 38, 39, 42, 61 and 62 will show that North America is very rich in all metals and minerals, and that they are very widely distributed.

Compare the situations of the chief deposits with the contour map.

How do they lie relatively to the mountain regions ?

Most of the other metals are found in veins either in very ancient igneous rocks, or in early sedimentary rocks which have undergone great changes. Such rocks are called metamorphic, thus marble is a metamorphic rock of similar chemical composition to chalk and limestone. Similarly, anthracite may be regarded as a metamorphosed form of coal, just as haematite is of iron ore. The veins of metals and ores have mostly been formed by deposition from solutions of metals which have trickled through faults and cracks formed in the rocks by movements of the crust of the earth.

How might this method of formation explain the occurrence of metallic minerals mostly in mountainous regions ?

Gold, besides its occurrence in veins, is also found in alluvial deposits formed by the degradation of quartz-bearing rock containing veins of gold. The gold is so much heavier than the quartz that it tends to collect in situations from which the running water carries away the lighter sand, or quartz. This alluvial gold is known

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to the miners as placer gold, as distinguished from reef gold.

Study maps 9, 42 and 61, and note the chief gold regions in North America. How do they lie relatively to the mountain systems? Why should the Alaskan gold region be named after the river Yukon? What would you conclude as to the character of the gold in that region?

Many other valuable minerals are mined or quarried in various parts of the continent, notably mica—especially in New Hampshire and Ottawa,—also apatite, consisting of phosphates, and asbestos, the last especially in Quebec.

For what are mica and asbestos, which have similar composition, respectively used? Apatite is used in making manures and fertilizers.

Good building stone of various kinds, also marble, are very widely distributed, the latter especially in Georgia and Vermont.

As a last, but by no means least important aspect of the geological history of the continent, bearing upon its present geographical condition, we might deal with the question of soil and its effects upon agriculture; but this can be best discussed in connection with the separate agricultural and pastoral regions.



Fig. 14.—GLACIATED REGION OF
NORTH AMERICA.

The shaded portions represent the extent of glaciation in North America.

Recall any soil especially suited to pasturage or agriculture.

There is, however, one other important geological factor that has greatly influenced the character of the soil, as well as the actual formation of the land, namely, the effect of the Ice Age, when the whole of the northern part of the continent, especially on the eastern side, was covered with ice. To the effect of this prolonged period of glaciation, which followed the tertiary geological age, we



Fig. 15.—HILLS FORMED BY ANCIENT MORAINES.

The fine rock waste deposited in these regions affords excellent soil for agriculture.

have already referred in explanation of the vast number of lakes of Canada and of the St Lawrence basin.

In what country of Europe are the lakes believed to be, partly at least, of glacial origin? How can a glacier help in forming a lake? What part is played in such formation by the terminal moraines?

Glaciation may have absolutely opposite effects upon the future agricultural possibilities of a district. For though advancing glaciers sweep the rocks bare of subsoil, they may as they retreat and melt away, leave an immense depth of finely divided soil which will prove of great value

to the farmer in later ages. This finely divided soil may in some cases be washed away by the river, which results from the melting ice, and may leave behind a surface of bare rock or gravel, valueless to the farmer.

Discuss how far (a) the slope of the land, and (b) the rate of melting of the glacier, determines which of these two results shall be brought about.

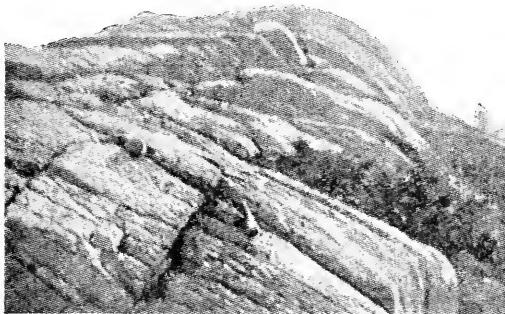


Fig. 16.—GLACIATED ROCK.

Note how in this case the rock has been scratched quite bare of all soil.
Contrast with fig. 15.

CHAPTER IV

NORTH AMERICA : CLIMATE

IN many respects there is no continent, or large stretch of inhabited territory in the world, which affords us a

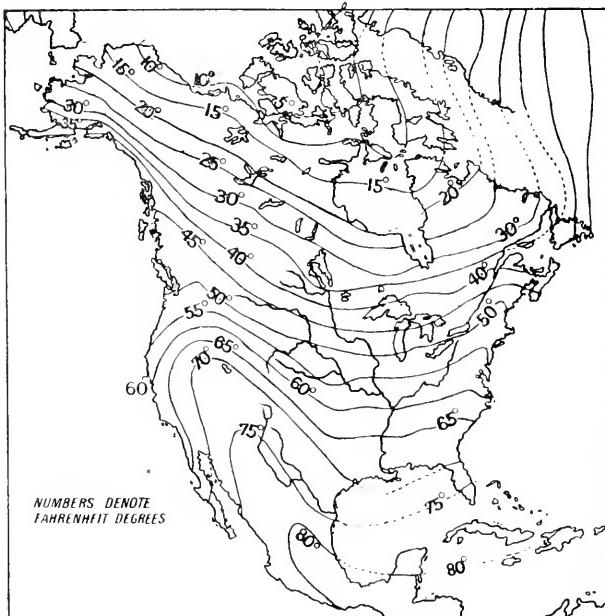


Fig. 17.—ANNUAL ISOTHERMS. (SEA-LEVEL.)

To what extent do these isotherms show the influence of latitude upon climate? Which of the tendencies of the curves are due to the influences of land and ocean respectively? Note how the rapid cooling of the northern land regions in winter and the rapid heating of the southern land regions in summer cause the northern annual isotherms to bend southward and the southern annual isotherms to bend northward over the land (*cf.* figs. 18 and 19).

better opportunity of observing the general factors governing climate, than does North America, stretching

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as it does from tropical to arctic regions, with a long western as well as eastern oceanic coast, and with a continuous range of lofty mountains parallel to one of these coasts. Our study is facilitated by the fact that the bulk of the continent is under the management and control of

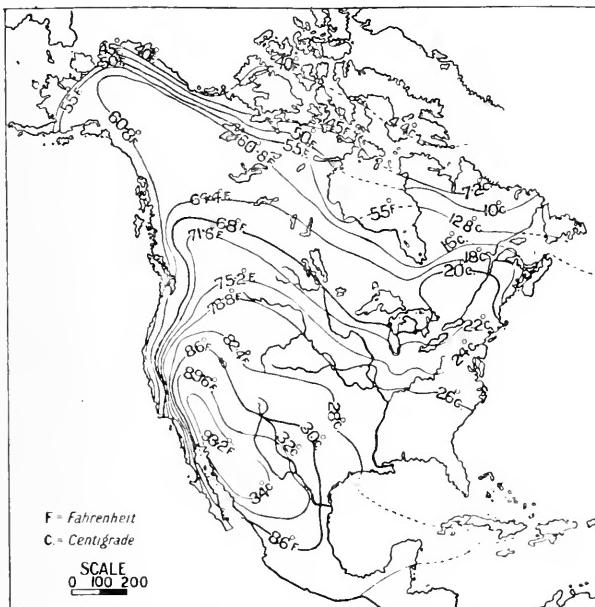


Fig. 18.—SUMMER ISOTHERMS. (SEA-LEVEL.)

In what way does the direction of these isotherms indicate that the Rocky Mountains form a climatic barrier? What would be the result to the isotherms if the moderating effects of the Pacific winds were not thus cut off? Compare the rainfall maps 20, 21, and 22, and suggest what differences in the climate of the States of Central Canada would arise if the Western Cordilleras were not there.

governments, which encourage the determination and tabulation of all the necessary scientific data.

What are the main factors determining climate? What are the influences respectively of (a) latitude, (b) altitude, (c) proximity of the ocean, (d) prevailing winds? Recall as illustrations, the climates of different places in Europe, e.g. London, Edinburgh, Berlin, Moscow, Lisbon, Rome, the Alps, the west coast of Scotland, the east coast of England.

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Study carefully the accompanying maps of North America, figs. 17, 18, and 19. What is the difference between the average annual temperatures of the extreme north and south of North America? What is the difference in the summer and in the winter temperatures? To what range of latitude do these differences correspond? In which season is the difference greatest?

Thus, while we note a marked fall in temperature in

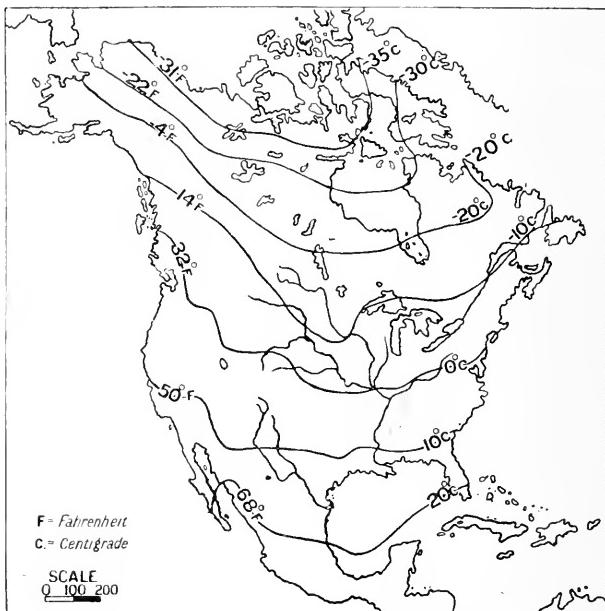


Fig. 19.—WINTER ISOTHERMS. (SEA-LEVEL.)

Why is the difference between the northern and southern extreme isotherms greater in winter than in summer? Cf. fig. 18. Consider the effects (1) of comparative breadth, (2) duration of sunlight, (3) of the freezing of the Arctic Ocean.

accordance with the change in latitude, we find the fall far greater in winter than in summer. This fact, which we shall discuss more fully in dealing with Canada, admits of simple explanation but is of the utmost importance. In the meantime it is, however, interesting to compare North America and Europe in this respect. In Europe we find a range of 50° F. in winter between the warmest

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and the coldest isotherm, and a range of 30° in summer, the greatest difference of latitude being some 35° . Thus we see an indication of the fact that the winters of northern Europe are much milder than those of North America.

Can you suggest reasons for this difference, depending upon (a) the accessibility of the northern coasts of each continent to the warmer drift currents of the Atlantic or Pacific Oceans, (b) the direction of the prevailing winds relative to the lie of the land and of the mountain ranges?

A further study of the isotherm maps also shows which parts of the country have a continental and which an oceanic climate.

In which map do the isotherms bend southward over the land? in which northward? How do you explain these facts? Compare the January and July temperatures of Winnipeg and Ottawa with those of San Francisco and Vancouver.

This difference between the oceanic and continental climate is, however, subject to variation owing to the build of the country. The tendency of mountains to form a climatic barrier, as regards not only rainfall but also temperature, is shown very clearly by the suddenness of the bend of the isotherms on the western side of the continent. Again, the central plain, protected on either side from the moderating winds of the distant ocean, has a far more extreme climate than the inland regions of the narrower country of Mexico.

Observe the similar influence of the Hudson Bay and the great lakes upon the climate of Canada.

The fact that the great central plain has no mountain barrier either to the south or to the north adds to the extreme nature of its climate. On the one hand it leaves the great northern plains of Canada open to warming influences from the south when the sun's summer heat

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over the central and southern plains is at its maximum ; on the other hand, it allows a cold current to flow from the Arctic regions on to the southern plains when, with the change of the seasons, a barometric minimum tends to be established further to the south.

How do the isotherms indicate these facts ?

We shall have reason later to refer to these considerations in discussing in detail the climate of the different regions and their influences upon agriculture. It may suffice for the present to indicate the importance of the point by a simple comparison. Wheat can be grown at Fort Simpson in Canada in latitude 62° whilst it cannot be grown in the North of Scotland. On the other hand while no frost is ever experienced in the Huertas of Spain, the orange crops of Florida are sometimes severely injured by it.

Compare the latitudes of Fort Simpson with Aberdeen and John o' Groats and Key West with Gibraltar.¹

With regard to the regions of oceanic climate, we find a marked difference between the east and west coasts.

Recall the general tendency of the isotherms of Europe. How does the difference between summer and winter temperature vary as we pass eastward through Europe ?

Though in the case of Europe this difference is partly due to its having no sea on its eastern boundary, we still find a similar tendency in North America.

Compare the summer and winter temperatures of San Francisco with those of New York. (See figs. 18 and 19.)

The former, though much further south, is cooler in

¹ If only wheat can be grown sufficiently far north to profit by the greater length of the day and consequent increased isolation of higher latitudes, it is thereby more readily ripened.

Why is this most possible in a continental climate ?

summer with a difference of scarcely more than 10° between its average January and July temperatures, while the latter is some 15° - 18° hotter in summer and over 20° colder in winter. It is evident that the ocean on the east coast in these latitudes has not so moderating an influence as on the west coast.

What is the general tendency of the prevailing winds in these latitudes? How does this explain the fact that in northern temperate regions the west coast of a continent has a more moderate climate than the east?

That the temperature of the sea, through the medium of the wind blowing from it to the land, does influence the climate of a district even when it is a wind of less frequency than the prevailing wind of the district, is instanced by the effect of the cold current on the coast of Labrador.

Note this in the direction of the -4° F. winter isotherm in fig. 19 and of the 50° F. isotherm in fig. 18.

It is, however, in the distribution of rainfall that the ocean and winds have their most widely distributed influence upon climate.

Study first of all the map showing the annual rainfall of North America (fig. 20). In temperate regions, which coast has the greatest rainfall? Which coast in sub-tropical and tropical regions has the greatest? How is this connected with what you have learned as to the great winds of these regions? (Compare with figs. 3 and 4.)

We thus account for the regions of greatest rainfall, and a comparison of the summer and winter rainfall maps will show in which seasons most of it falls.

In what season is it greater on the south-east coast? What is the position of the trade winds in the summer? Note that in the same season the rainy belt of the west coast moves northward? How is that dependent upon the same cause? (Cf. figs. 3 and 4.)

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It will be seen from these maps that while the various sections of the Rocky Mountains form a most effective

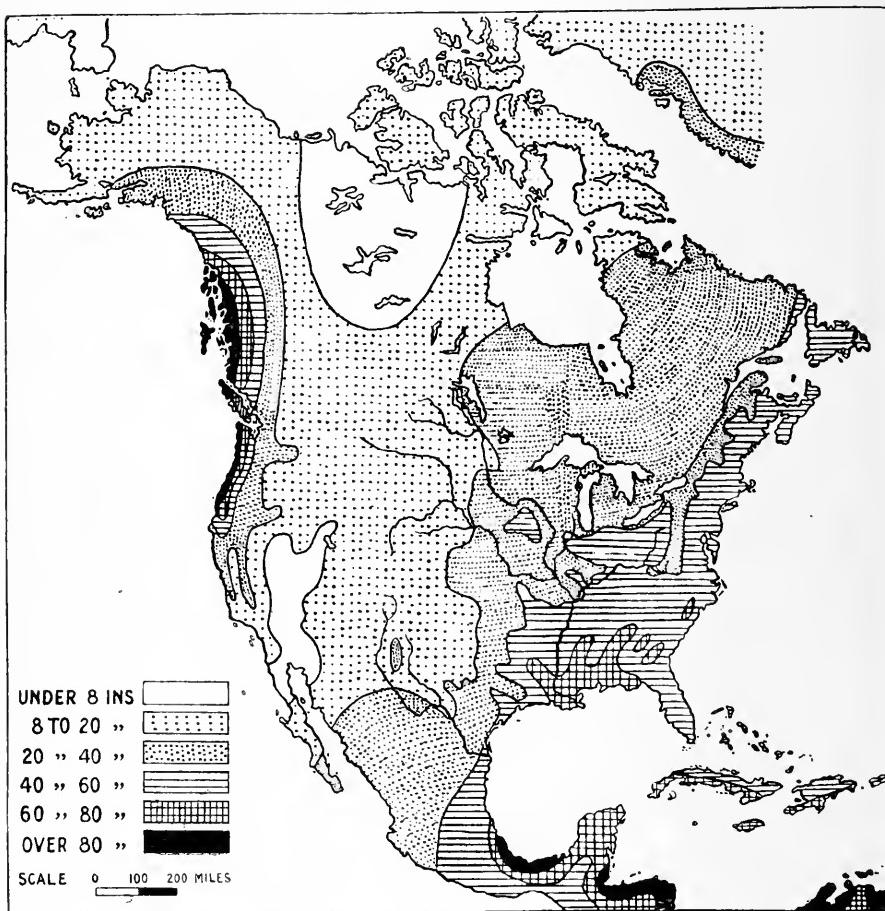


Fig. 20.—ANNUAL RAINFALL.

Compare with figs. 3, 4 and 9, and explain the regions of maximum and minimum rainfall respectively.

shelter and climatic barrier to the rainfall of the west coasts, the eastern ranges do not provide anything like so effective a barrier to the summer rains from the east.

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How might this be attributed to differences in the character of the eastern and western mountain groups particularly? Compare them as to extent and average height.

There is, however, another very important considera-

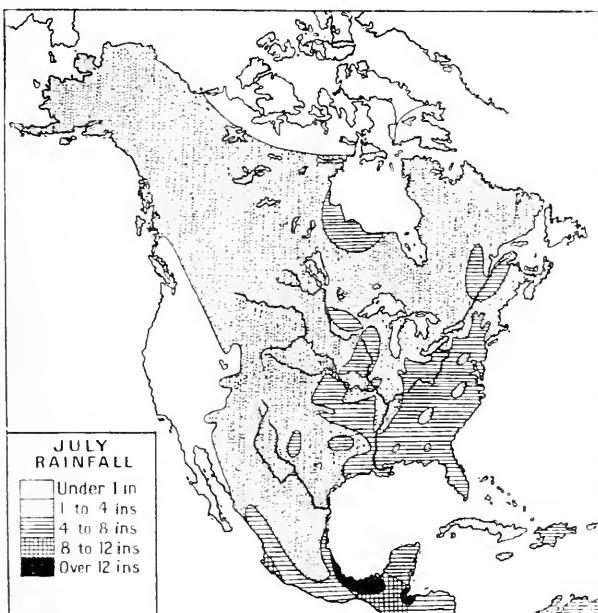


Fig. 21.—JULY RAINFALL.

Compare with fig. 3 and explain the region of small rainfall on the west coast. Compare with also fig. 22 and note that the central plains have summer rains. Explain this by considering the establishment of a barometric minimum over the plains in summer.

tion which greatly affects this seasonal distribution of rain over the continent.

What is the position of the Tropic of Cancer relative to the great plains of North America?

Thus during the northern summer the sun shines at a very high elevation over the vast plain of the Mississippi basin and tends to create each day in that region a strong barometric minimum, and air is drawn in from all regions around. That from the west has been deprived of most

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of its moisture in its passage across the Rockies, whilst that from the south and east brings in the little rain that falls in the summer in this region.

Compare the rainfall maps and show that most of the rainfall of this region is in the summer.

Also recall the reason why a centre of low barometric pressure causes rain.

The wind which as a consequence of this is drawn from

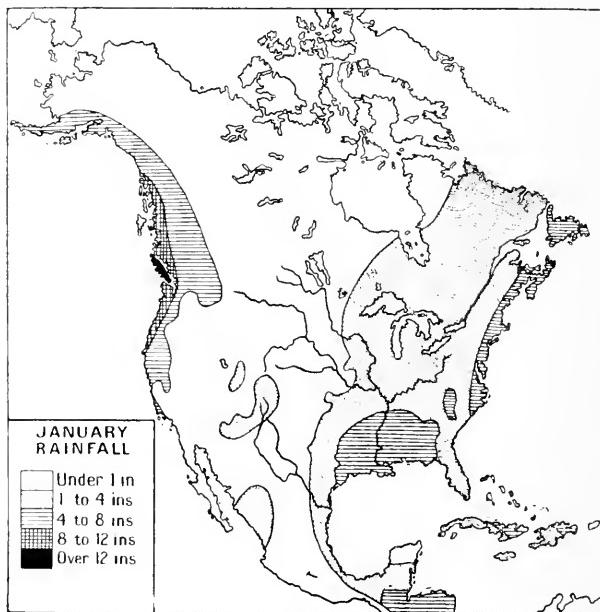


Fig. 22.—JANUARY RAINFALL.

Compare with fig 21 and note which regions have winter rains. What is the effect of the Western Cordilleras on the distribution of the winter rains?

the valleys of the great western mountain ranges is, like the Föhn wind of Switzerland, a falling wind and is known as the Chinook.

Recall the causes and the character of the Föhn. What changes take place in a wind as it rises over a mountain chain (a) in temperature, (b) in humidity? How does it alter in temperature

in falling down the other slope? What effect has this change on its power to absorb moisture?

Hence the Chinook is an extremely drying wind, and its effect in drying the grass, together with the continued absence of rain through the winter (see fig. 22) make it possible even in parts of Canada for the hay to be left standing so that cattle can graze out of doors all the winter through.

Another result of the great summer heating of the central plains is that the eastern portion of the continent is liable to a succession of cyclonic storms which are often sufficiently violent to be accompanied by lightning and thunder. The moist air drawn in from the Gulf of Mexico and the Atlantic is an essential factor, for further to the west, in the plateaux region, where the air drawn in to the areas of low-pressure is dry, such storms are rare.

We have had occasion in dealing with the weather of our own country to refer to the work of our meteorological office.

How is the daily condition of the weather over the British Isles discovered and recorded? What are isobars? What condition of the isobars is known as a cyclone? What condition as an anti-cyclone? How is the wind discovered to blow in each case? (See *Home of Man, British Isles*.)

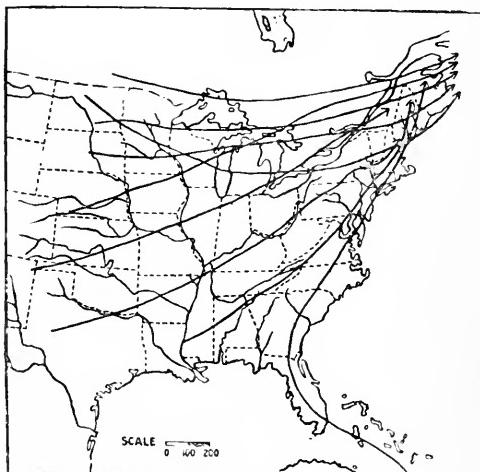


Fig. 23.—STORM TRACKS IN U.S.A.

Showing the directions most frequently travelled by the storm.

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For the sake of revision, draw two typical weather charts showing a cyclone and anti-cyclone respectively. (see fig. 24).

Where is the region of low-pressure in a cyclone? How must the wind blow relative to the regions of high- and low-pressure respectively? Which part of the States in fig. 24 is under the influence of a cyclone and which of an anti-cyclone?

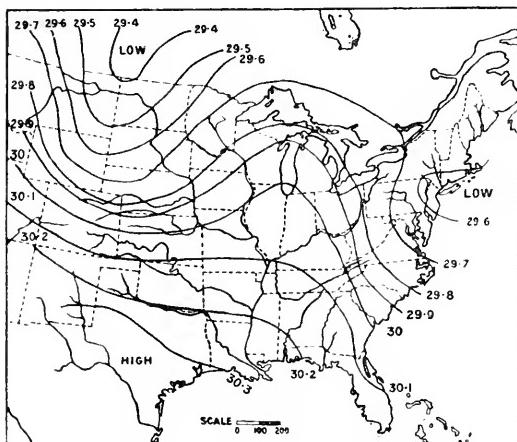


Fig. 24.—CYCLONE AND ANTI-CYCLONE.

How many cyclonic and anti-cyclonic areas respectively are shown? What is the nature of the weather in New York?

from without by the most direct route, *i.e.* radially and at right angles to the isobars, blows inward with a spiral motion. In the northern hemisphere this takes place in a direction which may best be described as counter-clockwise, *i.e.* in a direction opposite to that of the hands of a clock. On the other hand, in the anti-cyclone in the northern hemisphere, the outflowing wind takes up a clockwise movement.

Thus it will be seen that in the northern hemisphere whatever be the conditions of the distribution of barometric pressure—cyclonic or anti-cyclonic—if one stands

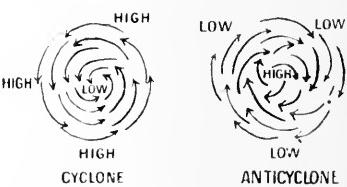


Fig. 25.

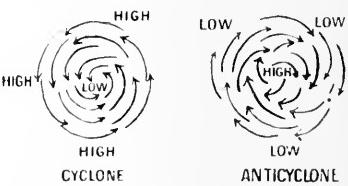


Fig. 26.

with one's back to the wind, the region of low-pressure lies always to the left.

The origin of these atmospheric conditions which so greatly influence man's life and which seem to be able to travel across the ocean from one continent to another, is worthy of further consideration and indeed admits of comparatively simple explanation.

The fact that the pressure of the air varies in different regions not very far apart, may arise from one of several causes, but perhaps most frequently from uneven heating of the air.

Whence does the air derive most of its heat, directly from the sun or from the surface of the globe? Which heats up more rapidly and to the highest temperature, land or water? In what regions of the globe does the sun have the greatest heating effect and produce the greatest pressure differences between land and sea?

We are not, therefore, surprised to find that the most numerous and most violent cyclonic conditions are found in tropical and subtropical island regions, as, for instance, in the West Indies. Imagine an island near the Tropic of Cancer. In the early part of the day the land will soon be much hotter than the surrounding sea, and wind will flow in from all round to the centre of low-pressure thus produced.

What direction was taken up by the winds flowing from the north to equatorial regions and forming trade winds?

For a similar reason the northerly wind blowing on to the island will be deflected to the west.

How will a southerly wind be deflected? Remember that it is coming to the island from a part of the world where the

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earth's circumference is greater and therefore where the earth and atmosphere have greater velocity. In which direction does the earth rotate?

Thus, while all the air blowing on to the island from the north turns in a westerly direction, that from the south turns equally to the east. It is easy to see how the combined effect of these tendencies is a spiral anti-clockwise movement to the centre.

A very little examination of the conditions of an anti-cyclone will show why its winds have a clockwise motion and further investigation reveals at once why we have

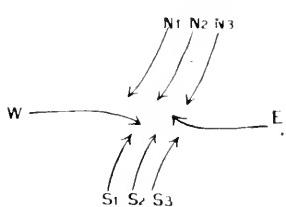


Fig. 27.

The final result will be the average (or resultant) of all the forces acting. All winds are blowing to the centre and all deflections are anticlockwise. Hence the anticlockwise spiral.

specified in each case above, that these conditions refer to the northern hemisphere only.

Make plans of similar conditions in the southern hemisphere and show by your diagrams that the cyclones and anti-cyclones are clockwise and counterclockwise respectively. If one stands with one's back to the wind in the southern hemisphere, on which hand does the region of low-pressure lie?

We are now in a position to understand how the very violent hurricanes and tornadoes so destructive to tropical islands are produced. We can also perhaps realize why the conditions of a cyclone are always more marked than those of an anti-cyclone, the latter being frequently no more than the natural recovery of the balance of pressure due to a series of cyclones. (See fig. 24.)

Account for the weather which accompanies cyclones and anti-cyclones respectively. (See *Home of Man, British Isles.*)

Sometimes on the ocean the whirl of the rising spiral

of wind in a cyclone may be such as to carry up a great column of spray and water called a waterspout.

It is only necessary to watch a swirl of water in a river and observe how one eddy after another is carried along down the stream to understand how these air disturbances may be carried across the ocean from continent to continent.

What explanation could be given of the contention sometimes made that the British climate consists of a series of samples sent over from America? In what direction would atmospheric disturbances travel across the Atlantic in temperate latitudes?

We must also make mention of a phenomenon which arises most frequently when the sun is moving to a more southerly position. Then the average position of the barometric minimum tends to move also to the south of the greater part of the mainland and thus in re-adjusting the balance of air pressure, a flow of cold wind is drawn from arctic regions southward.

In what way does the structure of the central plain aid this movement of the air? You are now in a position to explain the occasional frosts of Florida. In what season of the year will they occur? Why are they so dangerous to crops?

Finally, in tropical regions where the heating power of the sun is always great, there will obviously be no



Fig. 28.—WATERSPOUT.

summer and winter as in temperate regions. Even when the sun is at its lowest elevation the climate is warmer than the summer of temperate countries. These countries, however, do suffer an alternation of seasons of a different kind dependent mainly upon the prevailing winds. When over a large stretch of tropical country, the sun is at its greatest altitude, the land immediately under it suffers the maximum of heating and thereby becomes a region of minimum barometric pressure. If, as in India, the resulting inrush of air comes in mainly from the ocean and is therefore moist, the rising of the air will cause a rapid condensation of the moisture, and rainstorms, often of a very violent nature, result.

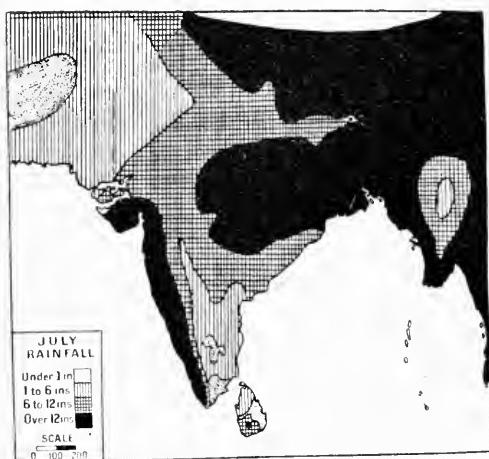


Fig. 29.—JULY RAINFALL OF INDIA.

This is during the so-called S.-W. monsoon. See fig. 3 and explain the region of maximum rainfall.

When, at the opposite season of the year, the sun does not produce a barometric minimum over the land, but establishes it farther north or south as the case may be, the country in question no longer forms a great area for the condensation of moisture, and, according to the nature and position of the country, a completely or comparatively dry season results. It may be, as in India, that the prevailing wind of this season is off the land and both dry and cool. (See figs. 3 and 4, and 29 and 30.) From an Indian word meaning

season, these periods are called monsoons, and most tropical countries fall in the so-called monsoon area.

At what position of the sun do these seasons occur? Show how an island on the tropic of Cancer will have a short season of maximum rainfall each year, whilst an island on the equator may have two such seasons in each year.

Local conditions may cause considerable variation in the amount of rainfall at either the wet or the dry season, but it may be taken as a general principle that in these so-called monsoon areas the wettest months either coincide with or follow closely upon the period of maximum elevation of the sun.

Which is the hottest month in Great Britain? Why does it not coincide with the solstice? What effect has the ocean in this delay of the hottest month?

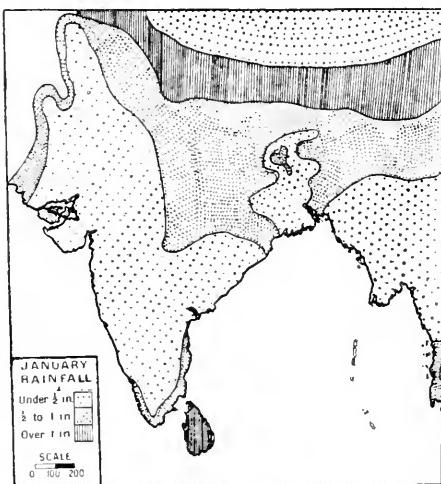


Fig. 30.—JANUARY RAINFALL OF INDIA.

See fig. 4 and explain the regions of maximum and minimum rainfall respectively.

Similarly in monsoon regions the wet season often follows the period of highest elevation of the sun.

EXERCISES

- (1) Study carefully the figures in the table (page 63) of weather records of selected towns in the United States. Which is the most northerly town? Has it the coldest winter minimum? Has it also the coolest summer maximum? Why not? What is the nature of the climate of Moorhead, being an inland town? Account for the low summer maximum and high winter minimum

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of San Francisco. How do they compare with those of New York? Which town has the smaller range of temperature? Which the greater? Upon what factor does this difference depend, *e.g.* between Key West and Cincinnati, or San Francisco and Moorhead?

- (2) Study also the table for British North America. How do the maximum and minimum temperatures compare with those of the United States? To what extent do they seem to depend upon latitude? *e.g.* compare Port Simpson with San Francisco, and Edmonton with Cincinnati.

Compare Halifax and Port Simpson as regards latitude, summer maximum and winter minimum, and yearly range. What do you note in the winter temperature in spite of the difference in latitude? What difference between the east and west coast is here once more emphasized? Which of all the towns mentioned has the most continental climate? Which the most oceanic? To what is the great range of the Belle Isle temperature due; to an extreme summer temperature, to an extreme winter, or to both? What causes its very cold winter?

- (3) Compare the climates of the east coasts of America and Asia respectively by means of the following table.

Asia	Lat.	Annual Average temp.	January Average temp.	America	Lat.	Annual Average temp.	January Average temp.
Vladivostock	43.2°	40.3° F.	5° F.	Portland	43.6°	45.3° F.	22.° F.
Pekin	39.9°	53.2°	24.0°	Philadelphia	39.9°	53.6°	31.8°
Okhotsk	57.9°	24.0°	7.6°	Nain (Lab.)	57.°	22.3°	6.9°

Which continent has the more extreme climate on its east coast in the winter? Which coast would you expect to have the warmer climate in summer? How does your conclusion agree with the following figures?

Okhotsk—Highest average monthly temperature for August 56° F.

Nain—Highest average monthly temperature for August 47° F.

TABLE OF TEMPERATURES

UNITED STATES

Place	Key West	Cin- cinnati	Moorhead Min- nesota Inland	Mar- quette Lake	San Francisco	New York
Position . . .	E. Coast	Inland			W. Coast	E. Coast
Lat. N. . . .	24° 34'	39° 6'	46° 51'	46° 34'	37° 48'	40° 43'
Long. W. . . .	81° 49'	84° 30'	96° 44'	87° 24'	122° 26'	74°
Maximum temp. . . .	83.8°	77.7°	68.4°	65°	59.4°	73.6°
Month	Aug.	July	July	July	Sept.	July
Minimum temp. . . .	68.7°	32.4°	3.8°	15.8°	49.5°	30.2°
Month	Jan.	Jan.	Jan.	Feb.	Jan.	Jan.
Yearly average	76.8°	55°	38.7°	40.5°	54.86°	51.6°
Range	15.1°	45.3°	64.6°	49.2°	9.9°	43.4°
Rainfall	37.8	38.5	24.4	32.3	22.4	44.9
Rainiest month	Aug.	June	June	June	Dec.	July

BRITISH NORTH AMERICA

Place	Labrador Belle Isle	Halifax	Montreal	Edmonton Saskatche- wan Inland	Port Simpson B. Columbia W. Coast
Position	E. Coast	E. Coast	Lake		
Lat. N.	57° 53'	44° 39'	45° 30'	53° 33'	54° 34'
Long. W.	55° 22'	63° 36'	73° 35'	113° 30'	130° 26'
Maximum temp.	53.3°	64.8°	69°	61.7°	56.7°
Month	Aug.	Aug.	July	July	July
Minimum temp.	9.0°	24.1°	15.6°	7.2°	32.5°
Month	Jan.	Jan.	Jan.	Jan.	Jan.
Yearly average	31.6°	43.2°	42.1°	36.1°	44.1°
Range	44.3°	40.7°	53.4°	54.5°	24.2°
April aver. temp.	28.4°	38.1°	40.6°	41.4°	42.3°
Rainfall	19.4	54.7	40.9	13.7	103.5
Rainiest month	Aug.	Jan.	July	July	Nov.

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- (4) To illustrate the distribution of monsoon rains study the following tables.

San Salvador. Average monthly temperature and rainfall.

Temperature. Inches of rainfall.

Jan.	61.8° F.	.08	$13^{\circ} 44' N.$
Feb.	62.8°	.16	$89^{\circ} 9' W.$
Mar.	64.5°	.56	
Apr.	66.3°	1.6	
May	65.6°	6.8	
June	64.3°	11.0	
July	64.1°	12.8	
Aug.	64.1°	11.9	
Sept.	63.2°	11.8	
Oct.	62.7°	10.6	
Nov.	60.5°	1.9	
Dec.	61.4°	.4	

Which is the hottest month? Which the rainiest? Plot two curves upon the same paper to show these monthly variations and note how the rainfall curve follows a couple of months or so behind the temperature curve. What does this mean? What is the nature of the climate of San Salvador—oceanic or continental? Why does the nearness to the ocean delay the heating of the land? See figs. 3 and 4, and shew the effect of the seasonal changes in the winds. Note the small range of temperature. Determine it.

CHAPTER V

THE UNITED STATES OF NORTH AMERICA

Study a political map of North America and discover into what countries it is divided. Which of them are British? Roughly estimate by measurement or by the use of squared tracing paper which has the greatest area. Compare their areas on a globe with that of Great Britain and that of Europe. Name and describe the boundaries of the different countries, distinguishing between artificial and natural boundaries. What is the nature of the boundary between the United States and British North America (a) in its western part, (b) in its eastern, and (c) in the extreme east? To which country does Alaska belong?

Though British America is the largest country of America, it will be advantageous for us to make a study first of the United States, for, as we shall discover, this region of North America has undergone far greater economic development.

Can you suggest reasons for this, dependent (a) on the early history of American exploration? (b) upon climatic conditions?

Make a careful map study of the United States. Between what lines of latitude and longitude respectively does this country lie? (See fig. 8 and discuss the time difference between New York and San Francisco.) What is the nature (a) of its eastern coast? (b) of its western coast? Which is the longer? Which has the greater number (a) of inlets? (b) of navigable river mouths? Compare the immediate hinterlands of each coast. What is the nature of the southern coast? To what extent may the country be said to have a northern coast? Name the chief river and lake ports on the north. How do the mountains and plains lie? Name the chief ranges comprising the eastern mountains and also those comprising the western Cordilleras. Locate the Wasatch, the Cascade, the Sierra Nevada, and the Coast ranges, the Columbia plateau and the Colorado plateau (fig. 9).

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Name one or two of the highest peaks in the United States. Find the chief passes across the Rocky Mountains. Find the Great Basin. By which mountains is it surrounded? What do you



Fig. 31.—A CAÑON.

Note the evenness of the plain through which the river has cut the cañon and also the varying slopes of the walls of the cañon, vertical where the rock is hard and sloping where the rock is friable. Suggest features in the picture which show that the river is flowing through an arid region.

note with regard to its rivers? How do you account for the Salt Lake of Utah? Why does it not fill the basin to overflowing? Find the Ozark mountains and note their peculiar and isolated position. Name the chief rivers flowing into each sea, and also the ports

situated at their mouths. Which is the largest river basin in the States. Where does the river rise? Near which great Canadian river? This comparatively low-lying spot forms part of the Canadian water-shed, known as the Height of Land. (See fig. 52.) Which tributary drains the eastern mountains? Which the western? Name two tributaries of the Missouri. Trace them to their sources and thus discover the position of the National Yellowstone Park in the Yosemite Valley. Name the cities situated at the junctions of the Mississippi with its two main tributaries. Note the position of the Colorado River which in common with many of the Western rivers has cut deep gorges called cañons (see opposite). Which rivers form boundaries between the United States and other countries? Observe also which rivers serve as boundaries between the states. In which group of states are most lakes found? What fact in the geological history of North America accounts for the formation of these northerly lakes? To answer this question recall the causes of the formation of the Swiss lakes and see fig. 14.

There is no country in the world which has cultivated and developed vast resources to so great an extent as the United States of America. To appreciate this we need only to realize that thirty or forty years ago the country occupied the position of an agricultural but otherwise imperfectly developed community. Then raw materials and foodstuffs were produced for the use of other more advanced countries; now it finds a place among the foremost nations of the world in the magnitude and quality of its trade and manufactures.

It is obvious that such a rapid growth can only have taken place directly in accordance with and as a result of geographical conditions. There is, therefore, no country in the world that better illustrates the geographical factors which at present determine the Home of Man.

A glance at the population map will at once suggest some interesting questions, some of which, however, must

only be answered after due consideration of the history of the country.

Which is the more populous half of the country? In which direction has the tide of immigration flowed? Can you suggest why settlers in the more populous regions on the western coast have not moved so rapidly eastward? Apart from difficulties of navigation, how have the States in the past been protected from

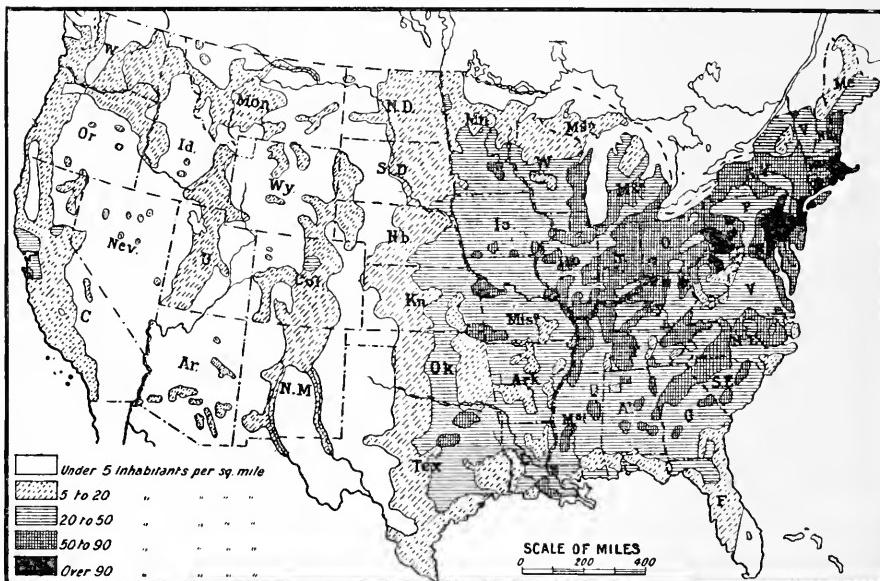


Fig. 32.—DENSITY OF POPULATION.

Compare this map with the railway map fig. 40. What do you observe and what do you conclude as to the relation of railways to national development? Compare the above carefully with figs. 9 and 20 and account for the situation of some of the least populous regions; also with figs. 38 and 39, and account for that of the most populous regions.

Asiatic settlement and invasion? What considerations (structural or climatic) have protected America in the extreme north, where the distance from Asia is the least?

The way in which the structure of the country not only determines more or less the character of its first settlement but also gives direction to the tide of immigration is shown by a careful study of the map and of the manner in which the country has developed its resources.

Travelling from east to west, the United States may be classified into a series of almost parallel regions.

(1) THE TIDEWATER REGION.—The first of these, the eastern coast region, is known as the Tidewater region and consists mostly of low-lying land with lagoons and tidal estuaries. Fortunately these drowned river valleys, owing to the repeated rise and fall of this coast in past geological ages, have deep channels adapted for navigation by large vessels.

Name the large bays or sounds thus formed and the chief ports situated on them.

If we travel up these estuaries and enter the rivers emptying into them, we pass for a time through the broad low valleys of the alluvial coastal plain, but soon we reach a point at which a marked rise of the land takes place.

(2) THE PIEDMONT.—Here we find deep gorges, with rapids and waterfalls caused by the harder character of the rock over which the rivers flow. This is known as the *Fall Line* and marks the point at which the rivers leave the ancient land level of the continent, the coast of which in previous ages was situated hereabouts. The old level is marked by a plateau which slopes gently upward and westward and as a result its rivers have cut deep gorges in it and at its eastern border tumble in falls and rapids to the plain below. This strip westward of the Fall Line is known as the *Piedmont*, or, as the derivation of the word implies, foothill region, and forms the second great strip. A glance at fig. 33 will show of what great importance this line has been in the determination of the situation of some of the most important towns of the Atlantic states.

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How is the position of the town on the Fall Line affected by (a) considerations of navigation on the river? (b) considerations of power for machinery? How has it especially affected settlements engaged in (a) the lumber trade? (b) the weaving industry?



Fig. 33.—THE FALL LINE.

A line joining the towns here marked, omitting New York, will show the Fall Line. Trace this map and mark the Fall Line on your tracing. Compare it with the coast line and the 100-ft. contour line in fig. 9.

Compare fig. 33 with the various industrial maps (figs. 34-42 and 45, 47, 48), note the industries of each town on the Fall Line and discover which of the above considerations has determined its position, e.g. Bangor, a lumber depot; Manchester and

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Nashua, with cotton mills; Baltimore, a great shipping port; Richmond a trade centre, with cotton mills and tobacco factories; Petersburg, with cotton mills and tobacco factories.

The great value of the water power thus afforded has in the past, even before the great development of



Fig. 34.—TOBACCO-GROWING REGIONS.

Tobacco will ripen under a great variety of conditions, provided it is not subject to frost in its early stages. Hence it is widely grown in the United States and the most important regions are marked in the map above. Account for the names B.D.V. (Best Dark Virginia), Richmond Gem. Name a port connected largely with the tobacco export trade.

railways, more than compensated for the loss due to the corresponding obstacle to internal communication. On this line, therefore, and between it and the coast are to be found the oldest settlements of the United States.

Cereals, fruit, and tobacco are the chief agricultural products of this Piedmont region, especially in the south-

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eastern states, in which also the chief industry, as already seen, is cotton spinning (fig. 35). The whole region is well forested, and lumbering forms a staple occupation on many of the rivers (fig. 36).

Name the chief ports of this region, discovering from the industrial maps which ports have a large general trade and which depend almost entirely on trade in one article in each case.



Fig. 35.—COTTON GROWING AND MANUFACTURING AREAS.

Cotton requires a warm climate, free from frost, and the soil, though moist at first, must become quite dry and warm as the plant approaches maturity. Show by comparison with figs. 17, 18, 19, and 20 how these conditions are realized. The presence of lime salts in the soil is advantageous and is amply provided in the so-called Mississippi "bottoms" (flats overflowed from time to time); see fig. 10. Compare also with figs. 33, 38, and 39, and determine in which regions water power and fuel are used respectively for spinning and weaving. In comparing with fig. 33, name some of the oldest cotton spinning towns. Name (a) some of the chief towns connected with this industry; (b) two ports from which raw cotton is exported; (c) two ports at which raw cotton is imported. Find a town named after an English cotton town.

Except in the middle Atlantic states, in which the Fall Line is nearer the coast, the coal or iron industry is little developed.

(3) EASTERN MOUNTAINS.—The third natural division of the States lies to the west of these two narrow belts



Fig. 36.—LUMBER REGIONS.

Compare with figs. 9 and 20 and discuss the situation of the chief lumber regions. Why is there so little timber in the Great Basin? Why is it that lumbering in the far northwest is not developed to the extent warranted by the supplies of timber in that region? How may this be affected by the opening of the Panama Canal?

and consists of the Eastern mountains with a much dissected plateau on their eastern border, and owing to the presence of large quantities of iron ore as well as of fuel of all kinds, e.g. bituminous coal, anthracite, petroleum, and natural gas, this forms one of the busiest industrial centres of the world.

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Study figs. 37, 38, and 39 and note the positions of the chief industrial towns of this region. Observe the position of Pittsburg, which because of its rich supplies of fuel is one of the chief iron and steel towns of the States; also of Buffalo. How is Pittsburg well situated for the distribution of coal and coke, of which it sends out thousands of tons yearly? Name the rivers at the

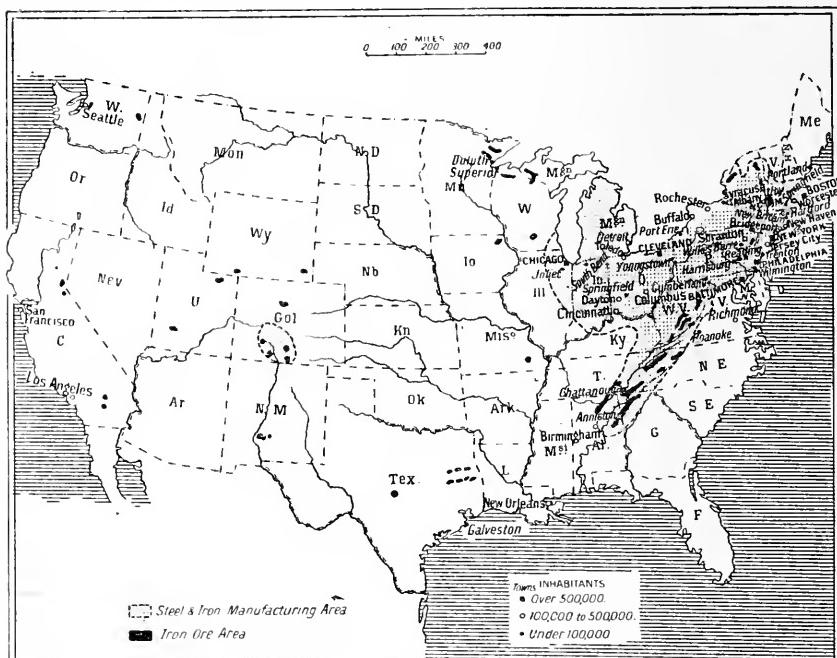


Fig. 37.—IRON AND IRON MANUFACTURING REGIONS.

Compare carefully with figs. 38 and 39, and note carefully which iron regions are situated near supplies of fuel and hence account for the position of the chief manufacturing area. Why is so much iron ore exported from Duluth and Superior and imported at Cleveland? Note that the Pennsylvania iron smelting district is largely dependent on ore from the shores of Lake Superior. What mineral in England is carried for economical reasons by boat from one port to another. Compare this map also with fig. 32 and explain any apparent connexion between them.

junction of which it stands. In both these cities natural gas is used as an illuminant and for power. Near what other great natural source of power is Buffalo situated? How is water power used nowadays? Observe the position of Oil City and Olean, and account for their origin and names; also account for the name of Cleveland. How do you account for the fact that

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New York, Newark, and New Jersey should be great manufacturing cities as well as ports and commercial centres? What form of fuel can be most easily brought to New Jersey? How is it conveyed? Account for the oil refineries of that city? Where in Europe is oil similarly transported? Note the position of Scranton and Wilkes Barre, the chief centres for anthracite.

The industrial development of all this mountain and



Fig. 38.—COAL FIELDS.

Compare carefully with figs. 32 and 40 and show to what extent the industrial development of the United States has been dependent on its excellent coal supplies. Note the wide distribution of coal on the Pacific border. Some valuable deposits of anthracite still await exploitation.

plateau belt has been greatly aided by the structure of the region itself.

How do the mountain ridges lie relatively to the coast? Note the "Great Valley" which extends from the Hudson to the Alabama River. What have you already observed as to the peculiarity of the water flow relatively to these ridges?

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Name the chief ridges and any rivers that cut through them.

Which section of the mountains forms the water-parting between the Hudson and the St Lawrence basin (through Lake Champlain) ? What is the Delaware water-gap ?

A careful examination of the railway map (fig. 40),



Fig. 39.—PETROLEUM AND NATURAL GAS REGIONS

Compare carefully with figs 35, 37, and 40, and note which of the largest cities are within easy reach of oil supplies. Can you suggest why a relatively large proportion of Californian oil should be sent out of the country? Consider the accessibility of these oilfields relatively (*a*) to the coast, (*b*) to large industrial centres in the United States.

showing the chief connections and railway centres indicates to us how serviceable these water gaps have been to trade and commerce. Atlanta, the capital of Georgia, is a noteworthy instance of a town the growth of which as a great railway and commercial centre is to be attributed to its position at the end of the Blue Ridge.

As we have already indicated, fertile land is well distributed in this region, providing ample food-land, both grazing and arable, for its population, and yet it is not here that we find either the chief grazing or corn land of the States (figs. 41, 45, and 47).

(4) THE CENTRAL PLAINS.—It is the great central plain,

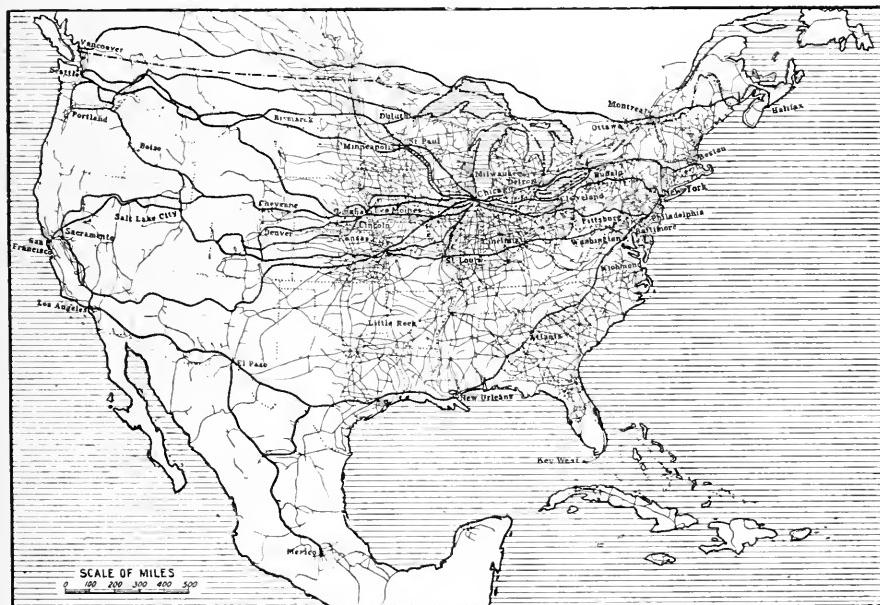


Fig. 40.—CHIEF RAILWAYS.

The transcontinental routes are shown in heavier lines.

Compare with fig. 32 and explain what you observe, also with fig. 9 and a good atlas map to discover the valleys traversed in crossing the Western Cordillera. Note the influence of the Eastern uplands upon the railway network. Explain why the lines mostly take a N.-E. and S.-W. direction. Note the position of Atlanta, compare with fig. 11 and then observe its importance as a railway junction.

to which we must now pass, that provides the vast grazing and growing regions of the United States, a region which may lay claim to send foodstuffs of one kind or another to all quarters of the globe. This vast central plain falls into three divisions, distinguished to some extent

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both by climate and structure. First, a northern plain, broken on its eastern and western borders by bluffs, bounded on the south by low gravelly hills, which are the terminal moraines of a great ice sheet which once covered the whole of America to the north of this district

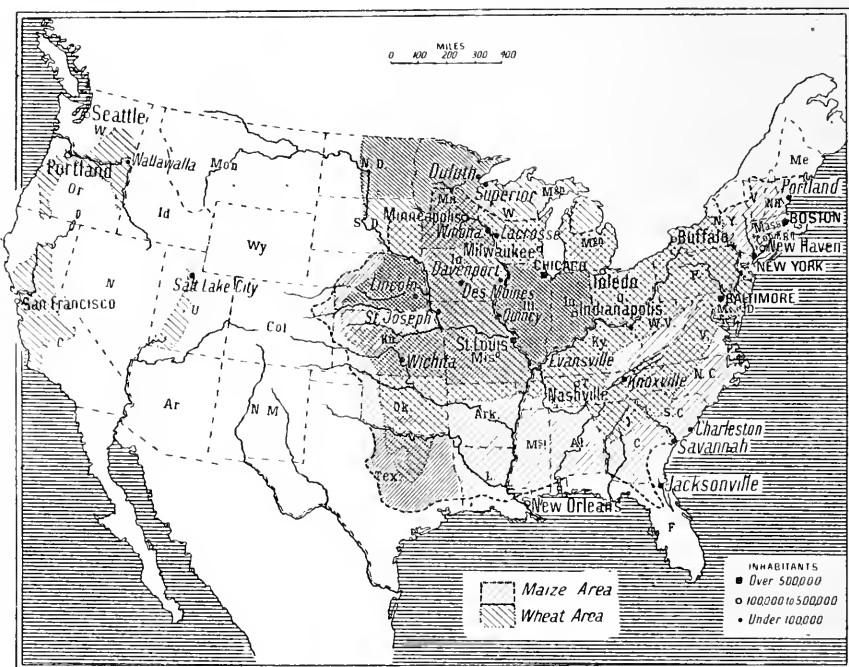


Fig. 41.—MAIZE AND WHEAT AREAS.

Darker shading indicates the regions or States of greatest production.
Make a list of the chief wheat and maize States respectively.

(fig. 14). This division is but a southerly extension of the drift-covered *Lake Plains*. Lumbering, grazing, dairy farming and agriculture are the chief occupations, though Michigan produces one-third of the copper, iron, and salt of the whole country (figs. 37 and 42).

Note the ports of Duluth, Superior, and Marquette, from which iron is exported to the Cleveland and other coalfields. Find

Houghton, the largest copper mining centre in the world. Is it on a coalfield?

Secondly, there lie to the south of these the vast prairies of North America, drift-covered plains once entirely grass covered now devoted to farming, especially

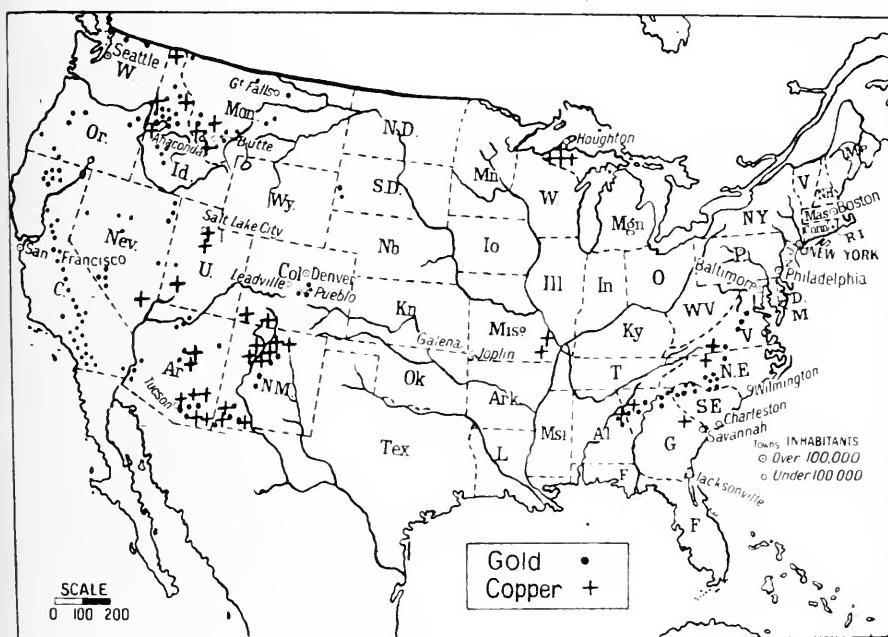


Fig. 42.—GOLD AND COPPER MINES.

Compare with maps 38-40 and show which of these regions are best situated relative to
 (a) supplies of fuel for smelting purposes; (b) industrial and manufacturing regions;
 (c) means of transport—rail and water; (d) important ports.

grazing, and also to growing Indian corn (maize) and wheat. They are called *Prairie Plains*.

Thirdly, from the mouth of the Ohio the plain slopes steadily toward the Gulf of Mexico, which it reaches with a swampy coast similar to the Tidewater region of the east coast. In this, the *Gulf Plain*, the Mississippi

meanders in a vast flood plain, which is at a lower level than the flood level of the river. Consequently the river has to be kept in by artificial banks, called levées.

Observe the delta of the Mississippi—note that it forms artificial banks out in the sea. How do you account for this? In answering this question consider where the stream flows faster—at its

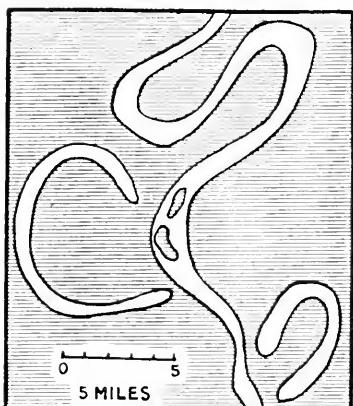


Fig. 43.—A MAP OF A SHORT SKETCH OF THE MISSISSIPPI IN ARKANSAS.

Recall from your previous studies the explanation of the meandering of rivers.¹ As might be expected the Mississippi meanders enormously, and after overflowing it has not always returned exactly to its old bed. Hence the formation of the so-called *oxbow* lakes shown in the plan above. Sketch a course of the river which would include both of the oxbow lakes shown.

centre or at its sides. What do you conclude (a) as to the rate of flow of the river? (b) as to the amount of deposit it carries? What do you consider will be the effect upon the rate of formation of the delta, now that the river is to some extent restrained by levées and not allowed to overflow its banks as readily as hitherto?

¹ See *Home of Man, British Isles*.



Fig. 44.—MISSISSIPPI DELTA.

Note the position of New Orleans. How far is it from the mouth of the river? How does it compare with London in that respect? The south and south-west passes are kept clear for ocean going vessels by dredging. To what extent does the position of New Orleans appear to have been determined by railway considerations? By far the bulk of the goods coming to New Orleans from its hinterland reach it by rail, the most important exception being the wheat which comes down the river in the so-called whalebacks.² Examine the coast line and suggest how Lake Pontchartrain has most probably been formed.

² See *How People Live*, Part II.

As a consequence of this flooding, cities were originally built on the bluffs bordering the plain, as, for instance, Memphis in Tennessee and Pine Bluff in Arkansas.

Compare the positions of these towns with the contour map (fig. 9).

In the central lowland region is situated the very

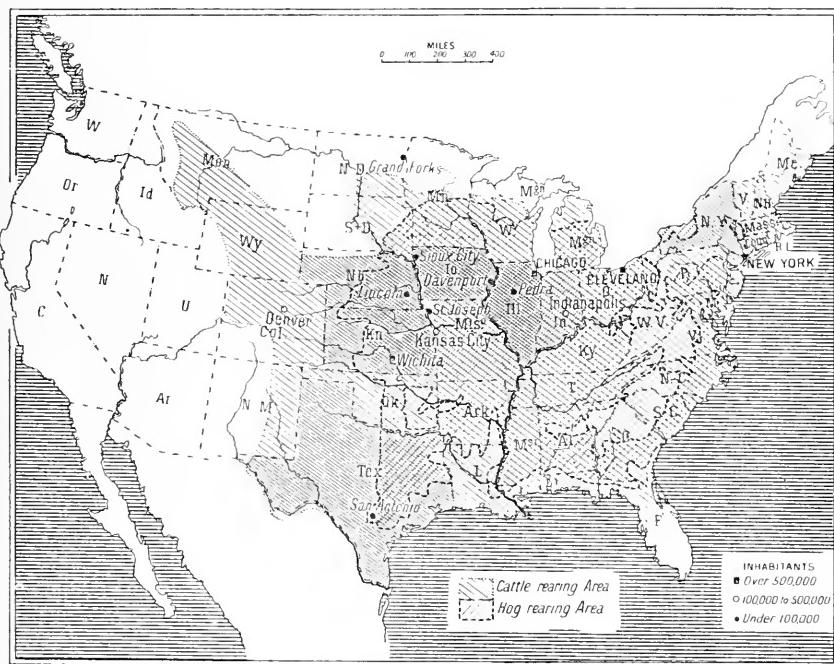


Fig. 45.—CATTLE AND HOGS.

Darker shading indicates the region or States of greatest production.

Which States are most concerned in cattle and hog rearing? Account for the situation of Chicago, with its enormous meat trade. Note from the atlas the position of Cincinnati, the centre of the pork trade in Ohio.

ancient uplifted and folded Ozark mountain region, which provides both timber for lumbering and grazing for sheep.

What river divides this region?

The distribution of grass, wheat, Indian corn, and

cotton in this great plain (figs. 35, 41, and 45) emphasizes the fact that the structural division roughly accords with a climatic one.

In which of the three regions are cotton, Indian corn, and wheat grown respectively? (figs. 35, 41, and 45). Where is most grazing? (see figs. 45 and 47). Compare figs. 45 and 41 noting that in America pigs are fed chiefly on maize.

(5) THE WESTERN CORDILLERA.—A careful study of



Fig. 46.—BAD LANDS OF DAKOTA.

Erosion in this region has proceeded so far and so rapidly as to remove completely all the rock waste which could have rendered the district fertile and habitable.

fig. 9 (contour map) shows that the plateau into which this plain merges on its western border rises steadily to a height of over a mile at the base of the Rocky Mountains.

This western region may be further subdivided into roughly parallel stretches of country running approximately north and south. The most easterly belt consists of the plateau already mentioned and generally known as the *Great Plains*. The map (fig. 20) shows this to be a region of small rainfall, though it is watered by

many rivers from the snow-clad peaks, or rainy heights of the Rockies.

Explain this fact. At which season of the year will the streams be swollen most (also see figs. 21 and 22).

The rivers in this region, because of their silt-laden



Fig. 47.—SHEEP GRAZING AND WOOL MANUFACTURES.

condition, are mostly broad, shallow streams, though in some regions, as in the soft rock of South Dakota they have cut a network of gullies forming a district called from its inhospitable nature, the Bad Lands.

Study figs. 34, 35, 36, and 41 and discuss the effect of the climate upon the character of the products of these regions. What is their chief value as food-land? Explain the absence of forests.

As we pass westward we reach the Rocky Mountains,

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clad on their lower slopes with forest, especially on the western side, while above tower bare and snow-topped peaks. In the parks and grassy valleys between these ranges there is much sheep-grazing. Indeed the bulk of the wool of the United States is produced here. (See fig. 47.)

Name the various ranges forming the Cordilleras. What name

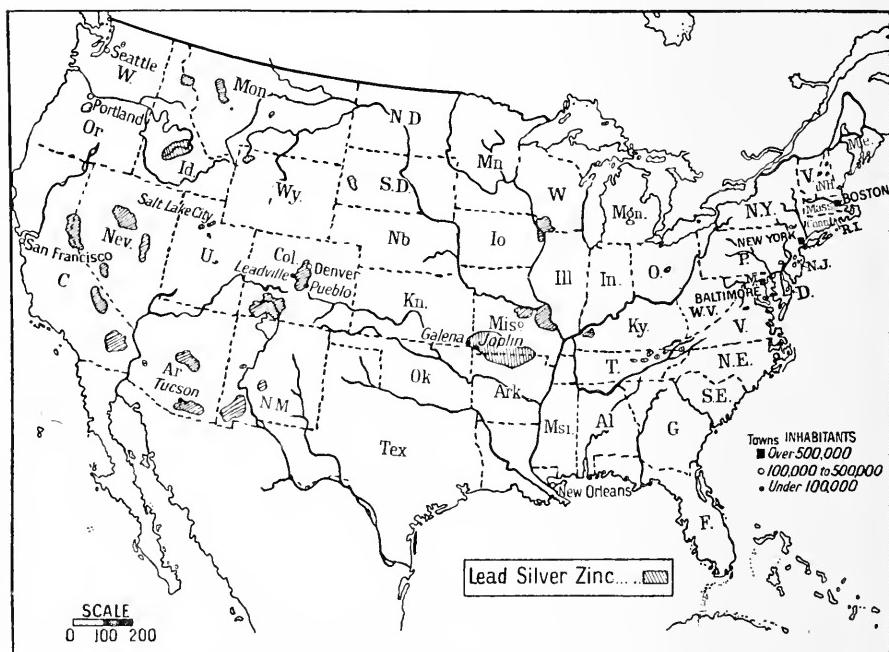


Fig. 48.—LEAD, SILVER AND ZINC DISTRICTS.

Compare with maps 38 to 40 and show which of these regions are best situated relative to
 (a) supplies of fuel for smelting purposes; (b) industrial and manufacturing regions;
 (c) means of transport (rail and water); (d) important ports. Compare carefully with
 fig. 42 and determine which are the chief regions and towns of the United States for
 general mining.

is given to the region enclosed between the Columbia and Colorado plateaux north and south and the Wasatch, the Sierra Nevada, the Cascade and Coastal ranges on the west?

The Great Basin, enclosed in this Cordilleran region,

is the most arid portion of the United States and is a region of inland drainage from the ring of mountains surrounding it.

Account for the saltiness of the lakes in this region and for the fact that few of the streams are permanent. See figs. 21 and 22 and state at which season of the year the rivers will be flowing. Why is irrigation from the mountains necessary in many parts?

Look at the industrial and production maps and determine the chief industries of these mountain regions.

It is undoubtedly due to the great upheaval of these mountain regions in past geological ages and to their past volcanic activity that so rich a variety of metallic ores is mined in the Cordilleran region. (Figs. 42 and 48.)

Name the chief ores mined in each district, also the most important mining towns. How does each communicate (a) with the coast? (b) with other parts of the States?

Remnants of volcanic activity are still to be seen in the great National Park on the Yellowstone River, where some of the most famous geysers in the world are in constant activity. These are springs of boiling water which at more or less regular intervals send up to a great height in the air a huge jet of steam and hot water. The hot water of these volcanic regions contains dissolved in it a form of silica, the chief constituent of all common rocks, other than the chalks and limestones. As the water from the numerous springs runs down the hillsides and cools it deposits the silica, delicately coloured by combination with different metals. This deposit is called sinter and beautifully coloured terraces are formed of it.

The action of a geyser is familiar to students of chemistry who have at any time used test tubes.

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Why is the test tube when heated always held at a slope? What happens if it is held vertically?

The geyser is believed to consist of a deep vertical tubular hole in the ground, into the bottom of which steam, probably superheated, *i.e.* above 100° C., passes

and is condensed. The water thus formed, together with some of that which has flowed back after the last eruption, is of course maintained at and near the boiling-point.

When water in a vessel is heated from below, how is the heat distributed throughout its mass? How does a tall, narrow, vertical vessel prevent convection?

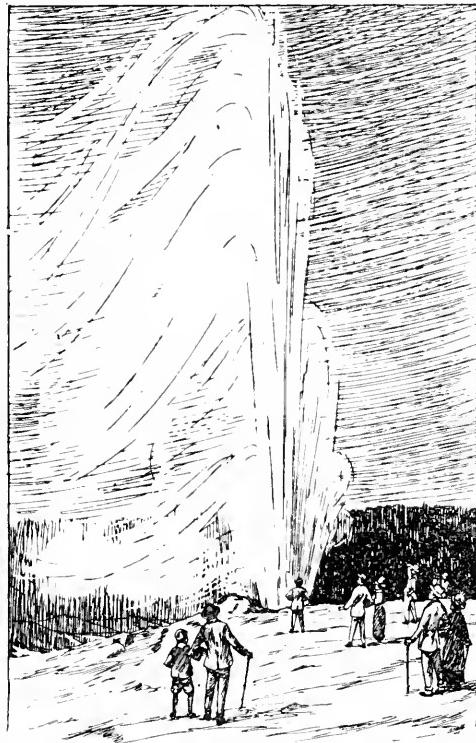


Fig. 49.—OLD FAITHFUL IN ERUPTION.

In addition to the narrowness of the outlet of the geyser is the fact that the silica in solution tends to make the water less fluid and therefore less free for convection. Consequently the water at the bottom of

the geyser gets hotter much more rapidly than at the top.

What is the effect of an increase of pressure on the boiling-point?

Thus the water at the bottom, because of the weight of the water above reaches a temperature above the ordinary boiling-point, and the whole mass gets heated

from below upward until a level is reached at which the uprising hot water finds itself at such a pressure that it can turn into steam. This takes place with such violence that the whole of the water above that level is shot into the air with tremendous force. The fact that a registering thermometer can be safely left suspended *at the bottom* during eruption witnesses to the probability of this explanation of the phenomenon.

(6) THE PACIFIC COAST REGION.—The most westerly belt of the United States is the Pacific Coast region. This consists of a series of hills which rise abruptly from the coast with a succession of broad lowland valleys separating them from their hinterland, the Cascade and Coast ranges. These hills were once islands like Vancouver Island, San Francisco Bay, for instance, being at that time a strait. A slow process of elevation has produced the valleys, and the fine rock waste from the great mountain ranges of which their soil is largely composed makes them some of the most fertile parts of North America.

What have we already learned as to the climate of the western coast (a) as to temperature? and (b) as to rainfall? (See figs. 17 to 22.) Why is the climate so much more moderate than on the eastern coast? Why is the rainfall considerable in the northern section, whilst in the southern parts irrigation must be employed? What will be the result upon the land and upon agriculture? Recall the nature of the Huertas of Spain and explain the contrast of the wheat-growing valleys of Washington and Oregon with the fruit-growing districts of California.

The Pacific coast includes some of the richest though at present not the most developed States of the whole country. The rich wheat and other crops of the northern valleys (fig. 41) provide a striking contrast to a considerable wool 'clip' afforded by the excellent grazing ground of some of the mountain slopes in the drier regions,

whilst in the moister mountain regions are some of the heaviest forests of North America (figs. 36 and 47). Nor have we completed the tale of their wealth when we have included the great fruit and vine districts of California, for the mountain ranges are rich in ores of all kinds (figs. 37, 42, 48). The western slopes of the Sierra Nevada contain the richest goldfields in the world, and mercury is mined in the central regions. A glance at figs. 38 and 39 will also show that coal is found in the north and petroleum in the south of California, thus providing a fair distribution of fuel.

Find the following towns on the map and account for their importance and trade.

Seattle—coal and lumber.

Spokane—manufactures—water power.

Wallawalla—grain and fruit.

Portland in Oregon—busy general port.

Astoria—Salmon canning. From what river?

San Francisco—the largest and busiest city on the Pacific coast.

Los Angeles—Fruit.

Tucson—Gold mining.

(7) ALASKA.

Name the chief river of this State. Having regard to the general tendency of the winds in this latitude and to the position of the country, explain the extreme wetness and the general equability of the climate on the Pacific coast in contrast to the extreme climate of the inland regions. Explain the very short summer. How does the length of the days to some extent compensate for that?

The chief industry of Alaska is mining, especially for gold, which is found in the beach- and river-gravels.

What name is given to this kind of gold? How do you connect it with the mining of gold in veins of quartz in the highlands of the same country? Can you explain why placer mining in a new district is always in advance of mining from the solid rock?

Note the positions of Nome, of the well-known Klondike river valley, and of Juneau, the present capital, all gold mining districts.

The quickest route to the Klondike region is by boat to Skagway and then by rail over the White Horse Pass, but in summer the Yukon is navigable and supplies are taken by boat up that river. As yet the large natural resources of copper and coal are not worked, on account of their inaccessibility and the inhospitable climate. Fishing, especially for salmon, which are canned, whaling and sealing, are also important industries.

QUESTIONS AND PRACTICAL EXERCISES

- (1) Study fig. 50 carefully and describe the situation of New York or Manhattan and its suburbs. What advantages does it derive from its situation (a) as a port, and (b) as a great commercial centre for the industrial states? What advantages has New York in situation (a) over New Orleans? (fig. 44), (b) over London? At what disadvantages is it placed? Consider its opportunities of expansion and incidentally account for its sky-scraping buildings. Note also that three sets of tunnels under East River connect Manhattan with Long Island whilst a similar number connect the two banks of the Hudson.
- (2) The chief articles of export and import of Boston, New Orleans, New York, and Duluth are given in the table below. Compare them with the industrial and other maps and explain the differences between them.



Fig. 50.—MAP OF NEW YORK AND ITS SUBURBS.

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TRADE STATISTICS OF U.S.A. TOWNS

Unit = £1,000,000

Town	Value of Total Trade	Value of Imports	Value of Exports	Value of Chief Imports	Value of Chief Exports
Boston .	45.1	31.4	13.7	Hides, skins 5.7 Wool . 4.7	Leather . 2.7 Meat, Dairy products . 2.5
New Orleans	50.9	16.7	34.2	Coffee . 8.2 Cane Sugar 2.8	Raw Cotton . 19.9 Wood . 2.3 Leaf Tobacco 1.8
New York .	387.0	213.7	173.3	Indiarubber 20.0 Coffee . 16.7 Sugar . 14.7	Oils . 17.6 Copper ingots 16.2 Machinery . 15.9
Duluth .	47.2	16.6	30.6	Coal . 6.2	Iron ore . 11.9 Wheat, Flour 10.2

Consider the chief imports and exports respectively of Boston. What do you conclude as to one of Boston's chief industries? When you have studied more closely the agricultural industries of Central America and the West Indies you will be able to explain the chief imports of New Orleans. Account for the chief imports and exports of New York. With what great engineering trade is the chief import connected? Explain also the chief import and export respectively of Duluth. For comparison the manufactures and industries of Chicago are shown in the following table :

	£1,000,000
a. Animals and their products	111.3
b. Iron, Steel, and Machinery	125.0
c. Miscellaneous	128.3

Connect *a* with the world-wide fame of Chicago and *b* with its position relative to the coal and iron districts of the United States (figs. 37 and 38).

- (3) Which are the oldest States? Compare the Eastern with the Western States as regards (a) area, (b) density of population (fig. 32), (c) railway development (fig. 40), (d) as regards the size and importance of their chief cities. Note that the official seat of

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government, Washington, does not belong to any one of the States. Name one or more of the chief States concerned in each branch of industry and agriculture (*cf.* figs. 34-43, 45, 47, 48).

- (4) Trace from an atlas an outline map of the United States, mark the sources of the Mississippi and all its tributaries. Join these points by a line. The area thus enclosed by the junction of this line with the coast will represent the basin of the Mississippi.

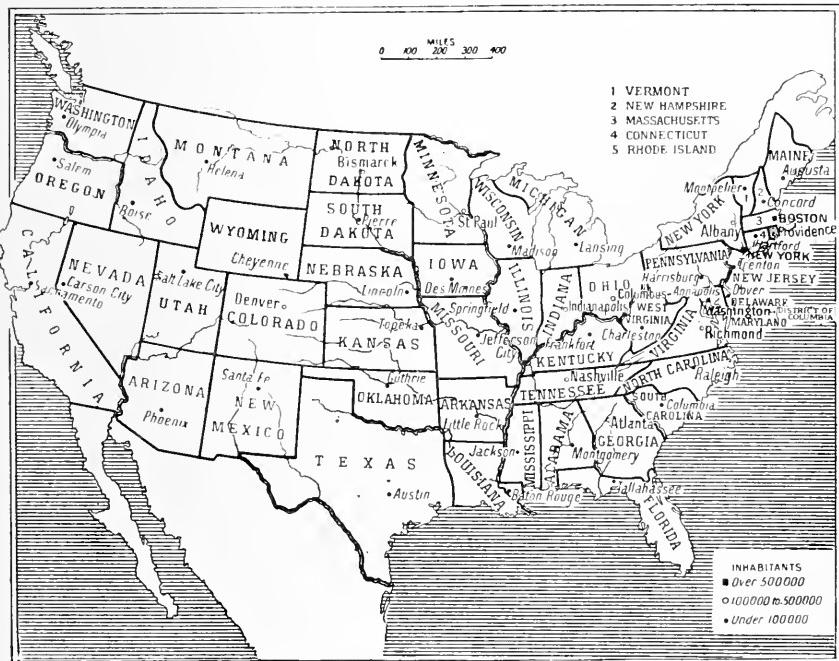


Fig. 51.—STATES AND THEIR CAPITALS.

Estimate roughly what proportion of the whole of the United States is thus enclosed.

- (5) Trace or draw a sketch map of the chief rivers of the Mississippi basin and from the industrial maps mark the chief towns situated upon them. Discuss the value of the positions of these towns to their respective industries. Note the position of the Falls of St Anthony at the head of navigation at Minneapolis. Connect this with the flour milling of this city.
- (6) Draw two squares or rectangles for the United States, one within the other. In the outer one let 1 sq. millimetre = 1000 sq. miles, and in the inner 1 sq. mm. = 500,000 people. Shade the popula-

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tion rectangle, and mark the scale below each diagram. If such diagrams for the different countries are entered together in the notebook, a comparative view of areas of and the densities of population in the different countries is thus afforded. (Appendix Table I on the same scale.) Do similar diagrams for the United Kingdom and New York State. South Carolina and Nebraska may be compared with Lancashire and Lincoln, by similar rectangles on a larger scale, *e.g.* 1 sq. mm. = 100 sq. miles and 1 sq. mm. = 500,000 people.

Thus for Lancashire a rectangle 5 mm. \times 4 mm. will represent the area of the country, but a rectangle 11 mm. \times 8 mm., *i.e.* over four times the area, will be required to be drawn and shaded to show its population. In no county or State of America will a density of population be found so great that the scale given, namely, half a million people to the 1000 square miles, will be attained, let alone exceeded, as in Lancashire. In comparing industrial Lancashire with New York State, and agricultural Lincoln with agricultural Carolina and the grazing State of Nebraska it is desirable to compare the areas of these States on the one hand with those of the English counties on the other. In what respect are they not comparable as regards density of population? Why may it be misleading to compare the density of two areas widely different in extent?

To avoid confusion all the area and density rectangles drawn to the larger scale should be kept together and those to the smaller scale in another page or pair of pages, and the scale clearly stated under each diagram or set of diagrams.

- (7) Draw rectangles to compare the imports and the exports of the United States with those of the United Kingdom rectangles on a base of 5 cm. and 1 mm. high per £10,000,000 trade. Draw horizontal lines across and blacken and label the portions of each representing the trade with Great Britain, British North America, and the United States respectively. Also note the chief class of import and export of each country, explaining the differences between them. (Appendix Tables II and III.)
- (8) Construct rectangles for U.S. 12 cm. \times 2.5 cm. and another 5 mm. \times 20 mm. for the U.K. to show roughly the relative area of the two countries. Divide the rectangles proportionately according to the amount of land (a) cultivated, (b) meadow or pasture land, (c) forests. (Appendix Table VI.)
- (9) Draw thick lines to a suitable scale to represent the total number of domestic animals (cattle, horses, sheep, goats, and pigs) in the U.S.A., U.K., and France respectively. Mark off

and label the section of the line corresponding to each animal. Which animal preponderates in each country? Why are hogs in so much greater number in the States? Upon what grain that is grown only in that one of these three nations are they fed? (Appendix Table V.)

- (10) Look at the table Cereals in Appendix Table IVa and compare with it the table of exports and imports. To what extent in this case are the U.S.A. self-supporting? Compare with the United Kingdom and France. What cereal do we import in large quantities from U.S.A. (See *Home of Man, British Isles*). Can you explain why much more wheat is produced per acre in England and Germany than in the United States or Canada?
- (11) Construct rectangles to show the comparative coal output of Great Britain and the United States. (Appendix Table VII.)
- (12) How does the U.S.A. compare with Britain in shipping and in railways? (Appendix Tables VIII and IX.) Which country is far better supplied with inland waterways?
- (13) How does the United States compare with Great Britain and also with other countries of America in the character and quantity of its agricultural products other than cereals? (Appendix Table IVb.)
- (14) Trace the contour map of North America (fig. 9) marking in the two highest contours. Copy on to this the chief inter-oceanic railway routes of the United States and note the routes they take through the mountain ranges.
- (15) When it is noon at Greenwich what is the time at New York, Minneapolis, Salt Lake City, and San Francisco? Find a city of U.S.A. whose local time is standard time and one whose local time is nearly half an hour earlier or later.
- (16) Study carefully the various industrial and agricultural maps and make a list of the most predominant States in each case. Name the towns and ports most intimately connected with each branch of agriculture and industry.

CHAPTER VI

BRITISH NORTH AMERICA

Make a careful study of the map of British North America. Between which parallels of latitude does it lie? Compare it in this respect with Europe. How do its southern and northern boundaries respectively compare with those of Europe (a) as to situation? (b) as to character? and (c) as to accessibility? Compare also the Atlantic coasts of Europe and Canada. Name in each case a great river forming an artery of communication with the interior of the continent. Compare the Rhine and the St Lawrence (a) as to direct distance from source to mouth, and (b) as to navigability. The Rhine is only navigable to its mouth ports—*e.g.* Antwerp and Rotterdam for sea-going vessels, for river steamers to Mannheim, and for barges to Basle; the St Lawrence for ocean-going steamers to Quebec or Montreal (according to draught) and for river and lake traffic with the assistance of canals to Fort William.

How do the mountains and plains lie? Which of the mountains are northward continuations of those in the United States? What mountains lie between the Rockies and the Coast ranges? Locate the Selkirks and the Gold Range. What characteristic do you observe of the river systems of Canada? Which is the largest river? How does it flow? Name the Lakes on its course. Name the rivers flowing into the Hudson Bay and into the Arctic respectively. Upon what rivers are the following lakes: Great Bear, Great Slave, Athabasca, Winnipeg? Upon how many of the rivers do we find important ports? Account for what you observe. Which large continental rivers rise in the so-called Height of Land? (See note fig. 52.) What important river flows out through Alaska?

Just as we have seen that the existence of so large a number of lakes in North America is dependent upon one factor in the geological history of the continent, so do we find that the present structure of Canada is the direct

outcome of its geological history. There are the regions of the world, as for instance the great sandy deserts or the larger alluvial plains, in which the results of comparatively recent factors, such as climate, have completely hidden the geological history of the region ; but

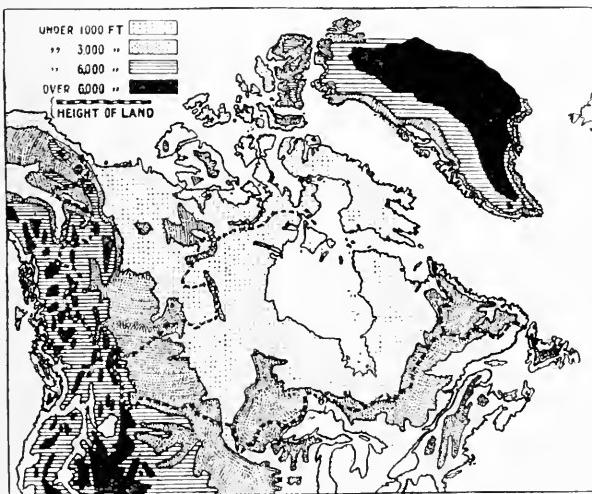


Fig. 52.—HEIGHT OF LAND.

This map shows the position of the main watersheds (Height of Land) of Canada. Note how large a part of the water parting is confined to comparatively low-lying land. Having regard to the general effects of prolonged denudation how might this fact be connected with the geological history of the country as regards either age or glaciation? Trace a map of North America to show the sources of the St Lawrence and the Mississippi and the Mackenzie Rivers. Draw a line on the map separating these river basins. To what extent does this line coincide with the Height of Land?

in Canada the reverse is indeed the case. Consequently we cannot better gain an appreciation of the present structure of the country than by studying it from the point of view of its geological history.

The most ancient mountain region of North America lay round Hudson Bay, the whole of the present land of which

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consists of Archæan rock, long since worn down nearly to bare level although its rivers do not show signs of age.

Describe some of the marked differences between a young and an ancient river bed.¹ How are these differences increased or decreased respectively by (a) the character of the climate? (b) the hardness of the rock? What do you recall as to the position of the ancient block mountains of Europe and of their effect, even after considerable denudation, upon the position and direction of the great mountain folds of the continent?

Round this ancient block or continental nucleus were deposited even layers of sedimentary rock, probably derived from its own denudation. By some movement, such as took place in Europe, a great folding of these sedimentary rocks in the south-east took place, forming the Appalachian Chain, which at its northern extremity was pushed up against the ancient high-land. The character of the rocks show this upheaval to have taken place in comparatively early geological times.

How do you connect this statement with the accessibility of coal and petroleum in the Appalachians?

To the west and south-west, sedimentary rocks were laid down, as we have already seen, to an immense depth, and it was not till a much more recent geological period that the great Cordilleran fold took place.

What is the nature of the evidence showing this to be recent?

It is the position of this ancient archæan nucleus that has determined the direction of flow of Canada's two largest rivers, the St Lawrence along its south-eastern border to the Atlantic, and the Mackenzie, flowing northward to the Arctic.

As we already know, the glacial periods were from a geological point of view, comparatively recent. Thus all

¹ See *Home of Man, British Isles*, p. 61.

this region was covered by an ice sheet after a considerable amount of land-formation had taken place. When, therefore, the ice retreated, some regions were left bare, and others covered with boulder clay or piled up moraine. It is these moraines which have been the chief cause in the blocking up of the courses of the older streams, giving rise to their lakes, waterfalls, and rapids.

You are now in a position to account for the young appearance of these very old rivers. Why are waterfalls and rapids usually regarded as a sign of youthfulness in rivers?

These two results of the glaciation of British North America have had opposite effects as regards commerce. While the great lakes, especially those connected with the St Lawrence, have provided excellent highways for trade; the rapids on almost all the rivers have greatly interfered with commerce by making communication impossible except by canals.

The following are the chief canals of Canada :

Sault Ste Marie Canal between Lakes Huron and Superior.

The Welland Canal between Lakes Erie and Ontario.

The Galops, Rapide Plat, Farrans Point, Cornwall, Soulange and Ladine Canals between Lake Ontario and Montreal.

State what rapids, rivers, or reaches they replace. In connexion with rapids, discuss the use of the light canoe by North American Indians.

Thus in accordance with this geological history, Canada falls into five main geographical divisions :

(1) The Archæan region, including Labrador, and most of Quebec in the east, northern Ontario in the south, and on the west stretching in a north-westerly direction from Lake Winnipeg to the Mackenzie River.

(2) The so-called Acadian region, including the south-eastern maritime provinces and the corresponding portion of Quebec.

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(3) The St Lawrence plain—the most fertile and most populous region, lying between Lake Huron and Quebec.

The remaining two divisions are merely northerly continuations of corresponding sections in the United States, namely :

(4) A central continental plain, and

(5) The Cordilleran Belt, with the western coastal plain.

The first of these, the Archæan region, as the name implies, consists mainly of ancient rocks such as granite,

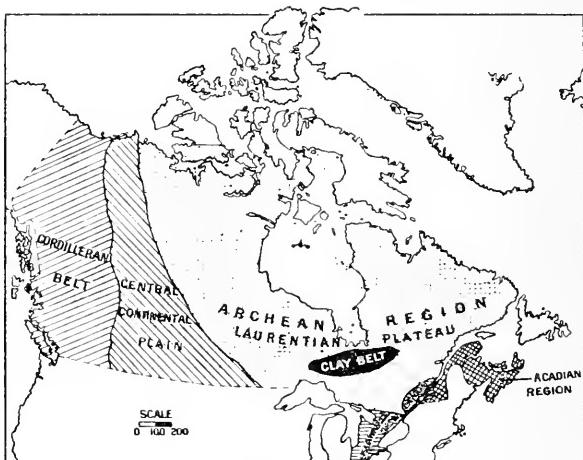


Fig. 53.—STRUCTURAL DIVISIONS OF CANADA.

and is the oldest part of the American continent. These hard rocks form the higher ground of what is left of an ancient mountain system that has undergone a great amount of degradation of one kind or another.

Describe the various degrading or denuding forces.

In some of the depressions, however, sedimentary rocks, usually greatly metamorphosed, are found, and these regions provide some important metal ores, viz. iron, copper, nickel, and silver.

What do you understand by a metamorphosed rock? Explain with reference to marble, limestone and chalk; slate, shale and clay.

Metallic ores are often found in connection with metamorphosed rocks inasmuch as the great heat and pressure causing the metamorphosis of the rocks may give rise to such chemical changes as result in the formation of metalliferous deposits.

This region is not agricultural, though from its southern border to the northern limit of the various trees, it is well timbered (see fig. 63). The whole region has a gradual slope from the Laurentian Highlands with an average height of 1500 ft. and a maximum of 2000 ft. on the south, to a lowland plain round Hudson's Bay of only a few hundred feet in height. The fall from the Laurentian highlands to the lakes is steep and the streams flowing into them have cut deep gorges with waterfalls.

In what respect are such rivers troublesome to lumbering? In what respect of great advantage to it? Consider the manufacture of the less useful wood into wood-pulp.

The Acadian region resembles the Cordilleran region in being an extension of similar structures and features in the United States.

Study the map carefully and show to what extent this is so. Note the parallel ridges of mountains. Observe the Notre Dame mountains of Quebec, forming the main axis and continuing parallel to the St Lawrence as the Shickshock mountains.

What peninsula does the termination of these mountains form on the southern side of the mouth of the St Lawrence? Look at the contour map. What is the average height of these mountains? How do they compare (a) with the Cordilleras? (b) with the Appalachians?

We are not surprised, therefore, to find that there is coal in these eastern regions, though the seams, in spite

of being widely distributed, are thin and of rather poor quality, except in Cape Breton Island, where there are very valuable deposits. The Atlantic coast of Nova Scotia is of ancient rock, some of it being gold-bearing quartz. In the southern portion of Quebec, included in this geological region, valuable deposits of both copper and asbestos are found (see fig. 62).

Most of this region when cleared has a fertile and productive soil ; but the bulk of its surface having been covered originally with primeval woods, lumbering is in many parts still the chief occupation.

Historically speaking, the third of our divisions of Canada is the best known and most important, namely the Great St Lawrence plain.

Study carefully the contour map (fig. 52) and, having regard to what has been stated above, discuss why this river valley and plain should have been the main centre of early settlement. Consider also the nature of early navigation, the chief necessities of the settlers, their dependence upon the soil, and the difficulties of transport and communication in those times.

We are not surprised, therefore, to find that the real wealth of this region, which stretches as a belt from Quebec to Lake Huron, depends in the first instance upon its soil and then, as we shall see later, upon its climate.

Measure the length of this valley, which stretches from Quebec to Georgian Bay in Lake Huron, and contains the most productive land of eastern Canada.

The steep southern slope of the Laurentian plateau which, as we have already seen, forms the northern boundary between the Archaean and these other regions, reaches the lakes at Georgian Bay and rises abruptly from the northern coasts of Lakes Huron and Superior.

In consequence of this, Lake Huron forms a western limit to the St Lawrence plain and in a railway journey from east to west one passes from the varied cultivation and agriculture of the Laurentian plain, through the rugged timbered granite hills of the Laurentian plateau,



[By courtesy of the High Commissioner for Canada.]

Fig. 54.—ORCHARDS.

and then emerges on to what seem to be almost endless stretches of grassy plain.

Name the States which are included in this fourth region, the central continental plain. Of what plain is it a northerly continuation? Study the contour map and structure map (figs. 52 and 53) and estimate the width from E. to W. of this vast plain (a) at the United States boundary, (b) at the mouth of the Mackenzie River, (c) at an intermediate latitude.

Compare this plain with that of European Russia, as to (a) the character of its rivers, (b) that of its water parting, and (c) the presence of lakes. Account for the fact that in each case the

strata lie almost evenly horizontal. How far north must we conclude the original central sea of North America to have extended?

Though most forms of fuel are obtained in this central region and all forms probably occur fairly plentifully, mining is not by any means the chief occupation of the



[By courtesy of the High Commissioner for Canada.]

Fig. 55.—FORESTS.

people. In spite of its northerly latitude, but for a reason which we shall discover later in studying in detail the climate of British North America, this is one of the finest wheat-growing regions of the world.

As in the States, this plain rises to the west to the foothills of a vast Cordilleran belt consisting, as in its southern continuation, of an inner ridge, the Rocky Mountains, and an outer coast range with a mountainous region between.

Find the position of the Selkirks, the Gold Range, and the Cariboo Mountains.

This, as might be expected from our knowledge of the United States, is the great metal-mining region of the Dominion. The western slopes of the central and coast ranges are densely wooded and their valleys are filled



[By courtesy of the High Commissioner for Canada.]

Fig. 56.—CENTRAL PLAINS : THRESHING WHEAT.

with almost tropical vegetation. The western coast is much indented with deep fjords, allowing of ocean navigation far into the land.

It is impossible to describe in a few words the climate of a territory so extensive and so varied in surface and structure that in one region or another all the factors influencing climate are well illustrated.

Enumerate some of the more important of these. Between which parallels of latitude does British North America lie ? Find places in Europe roughly in the same latitude respectively as Canada's

northern and southern limits. What do you know of the climate of, say, Rome in comparison with that of Cape North? What have we learned as to the climate of Europe as we travel eastward?¹

It will be remembered that when dealing with the United States, we discovered that there is a very marked difference in climate between the east and west coasts, and that, indeed, the country is divisible into climatic belts lying roughly north and south. Each of these belts is, of course, subject to a gradual fall of average temperature in passing from south to north.

Recall and discuss these different regions. Which coast of America has the greater fall of temperature in passing northward? What current cools the east coast? What current warms the west coast? How is it affected by the direction of the prevailing winds (a) in the lower latitudes? and (b) in the higher latitudes?

In Canada, while the west coast has a very mild oceanic climate very similar to the British and European climate of corresponding latitudes, the vast Cordilleran ranges afford a distinct climatic barrier and the central plain has a marked continental climate with hot short summers, and, especially in the northerly section, long cold winters.

Reference to the isothermal maps for North America, figs. 17, 18, and 19, will show to how great an extent the inland region of the Dominion varies in climate, though the extreme east, especially in its northern section, has a cold winter and a damp summer climate.

To what current is this due?

South of the St Lawrence, the maritime provinces have a milder climate with a fairly large rainfall, which diminishes as we travel westward to the eastern slope of the Rockies.

¹ See *Home of Man, Europe*, p. 45.

Study the isothermal maps and discuss the influence upon their course of (a) the Hudson Bay, and (b) the great lakes. The average winter isotherm for London is 40° F. and the average summer one is 60° F. Notice the position of these isotherms on the winter and summer maps of Canada respectively. Also note the position of the isotherm for 32° F. in winter. What do you conclude (a) as to the character of the Canadian winter? (b) as to the annual range of temperature? (See figs. 17-19.)

You are now in a position to explain the severe Canadian winter and, having regard to the great range of temperature involved in the change from winter to summer, how it comes about that it is followed by a very sharp and sudden spring. Perhaps, however, the most marked characteristic of the summer isotherm is the enormous bend northward it takes to the east of the Rockies.

What is usually the effect of an ocean on the direction of the summer isotherms? Why does this influence not penetrate further inland in this case? Does it depend on the direction of the prevailing wind or on the lie of the mountains? Can you recall and explain a similar effect in the case of Sweden?

This fact, that the great Cordilleran system has acted as a barrier to prevent the Pacific ocean from exerting its moderating influence upon the summer climate of the great central plain, has proved to be of the utmost importance to the economic development of the country.

Look at the summer isotherm map (fig. 18) and note the direction of the 60.8° F. isotherm. Where does it reach farthest north? Note on the atlas to what latitude it reaches. Compare this with the latitude of the north of Scotland, the summer of which is not warm enough to ripen wheat. (See p. 50.)

We thus see that central Canada has a much warmer summer climate than the corresponding latitudes of the British Isles, so much so that wheat is grown and ripened in the neighbourhood of Fort Simpson on the Mackenzie River in latitude $61\frac{1}{2}$ ° N. The winter isotherms in fig. 19

have already shown us the coldness of the winter in these northern regions of Canada, but even this factor is of great help to the cultivation of wheat. The sudden onset

of spring (fig. 57) thaws the surface of the ground just sufficiently to allow of ploughing and sowing, and as the roots of the growing plant penetrate into the earth they are provided with just sufficient moisture from the gradually thawing sub-soil.

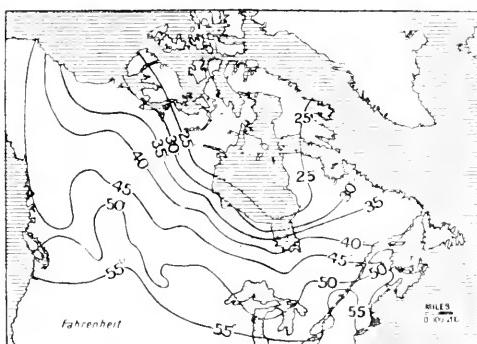


Fig. 57.—MAY ISOTHERMS.

Compare with fig. 19 and note how complete and rapid has been the thaw.

the amount of yearly rainfall of Edmonton and note which is the rainy month. As a matter of fact, in this region five-sevenths of the annual rainfall falls between May and September.

The winter cold and frost, therefore, in some of these regions do but serve to hold back, as it were, sufficient moisture in the soil to help in the development of the young plants in the early and warm spring.

Another factor which aids greatly in the warming of the climate of the central plain is the rapid lengthening of the summer days that follows the sudden onset of spring (fig. 58).

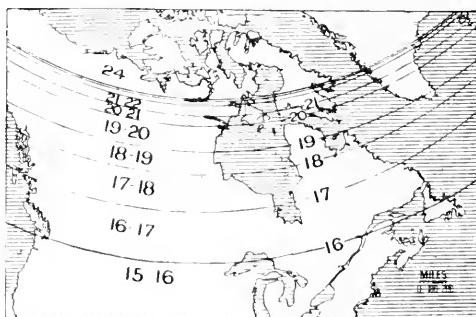


Fig. 58.—NUMBER OF HOURS OF DAILY SUNSHINE AT MIDSUMMER.

Another factor which aids greatly in the warming of the climate of the central plain is the rapid lengthening of the summer days that follows the sudden onset of spring (fig. 58).

Not only is the climate of the central States of Canada exceedingly favourable to the growth of wheat, but in these same regions, especially in the more southern parts, as indeed also in Montana and Dakota, there blows at intervals throughout the year a warm dry west wind known as the Chinook (see pages 54 and 55).

Over what mountains has this wind come? What has become of its moisture? What is the effect on the temperature of a falling wind, and therefore on its relative dryness? What falling wind occurs in Europe? What is the character of the Föhn? (See *Home of Man, Europe*, pp. 163, 164.) How were its origin and character explained?

In the more southerly districts, as, for instance, Southern Alberta and Southern Saskatchewan, these winds have the effect in winter of keeping the ground so free from snow, or severe frost, that cattle can graze out of doors all the winter through. The economic value of this factor in the climate of these regions can scarcely be over-estimated, its influence being felt even as far east as Edmonton.

Roughly estimate the distance of Edmonton from the Rocky Mountains.

In the more northerly regions, the advent of the Chinook is accompanied by the most remarkable changes in the weather. The thermometer rises from 14° F. (18° of frost) to 68° F. in a few hours.

Describe the effect upon the snow and ground, the former being probably at least a foot deep. What do you expect to be the effect upon the frozen rivers?

A flooding of the rivers is avoided by the fact that the Chinook wind is so dry that the snow is dried up as fast almost as it melts, the ground being left hard and dry.

How does this tend to avoid flooding of the rivers also in the spring?

A glance at the rainfall maps (figs. 20-22) shows this central region to have a small annual rainfall—everywhere under 20" and in some parts as low as 12". In these drier regions, too, droughts are liable to occur, and, in consequence, to avoid possible loss of crops, irrigation is being more and more widely employed. In some districts on the foothills of the eastern slopes of the mountains, the lack of rainfall is compensated for by moisture brought down from the hills beneath the surface, *i.e.* the ground water level comes near the surface. Such land is liable to the opposite danger of being waterlogged in an unusually wet season.

In direct contrast to the climate of this region is that of the eastern states of the Dominion. The differences, however, are capable of easy demonstration and explanation.

Compare the climates of the following regions and explain carefully their characteristics. Compare with figs. 17, 18, and 19.

Nova Scotia has a moderate summer, and the temperature seldom falls to freezing point in winter. The spring is slow. How do you account for this as compared with the sudden spring of the central region? The rainfall is moderate.

New Brunswick has plenty of snow in winter. How is this of value to lumbering (a) in land transport in winter? (b) in river transport in spring?

The rainfall is less than in Nova Scotia. Suggest reasons for this. Prince Edward Island—a delightful, moderate summer climate, sufficiently sheltered to be free from the Atlantic fogs. Recall the cause of these fogs and name the islands thus affording shelter.

Ontario. Observe the extreme boundaries of latitude of Ontario and compare them with the positions of London and Rome.

Explain, therefore, the positions of the chief isotherms and the ripening of peaches and vines in southern Ontario. What do you know as to the amount of snowfall in London and Rome respectively? How do you explain the low temperature and consequent permanence of the snow in winter in Ontario? With what part of Europe does it compare?

Quebec. The summers—at least in the west—are as warm as in Ontario, though the winters are colder. Study the isotherm maps and discuss reasons for the colder winter.

St Lawrence Valley. In the lower section the spring begins later and more slowly. Why is this of great importance to the fruit-growing of Montreal? Why is a sudden early period of warmth in our own country liable to be destructive to fruit trees?

British Columbia. Why should the climate here be so warm and moist and of all parts of Canada most resemble that of the British Isles and Western Europe? Which is the warm current of the

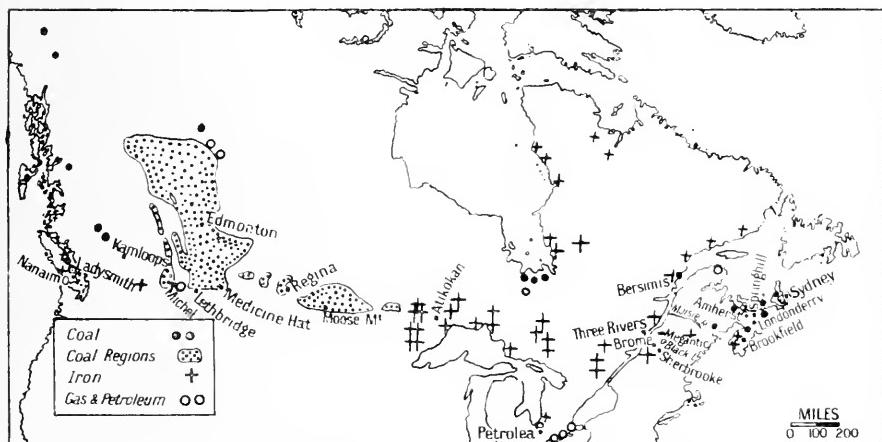


Fig. 59.—FUEL AND IRON REGIONS.

How are the iron districts of Canada placed (*a*) as regards fuel for smelting either from Canada or from the United States (fig. 38); (*b*) as regards transportation?

Compare with the map in the atlas and note the position of Calgary in the neighbourhood of which fresh sources of petroleum have been found.

Pacific which roughly corresponds to the Gulf Stream in the Atlantic? What influence has it upon the climate of this region? (Fig. 5.)

As in the States, so in Canada, there lie between the coast and the Rockies alternate dry and moist belts, the actual ranges themselves, e.g. the Selkirks—forming the moist belts and the intervening plateaux the dry regions.

Account for this. Can you suggest two reasons why the Selkirks have a greater snowfall than the Rockies? Would there be so much difference if the Selkirks were not so high as the Rockies?

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Study carefully the map showing the distribution of coal throughout Canada (fig. 59) and observe that this mineral is entirely absent from all the most populous parts of the Dominion, there being no deposits between the comparatively scanty supplies of New Brunswick and the coalfields of Manitoba which, though extensive, are not much worked.

Whence can the manufacturing towns of Ontario and Quebec obtain fuel, both anthracite and ordinary coal? Account for

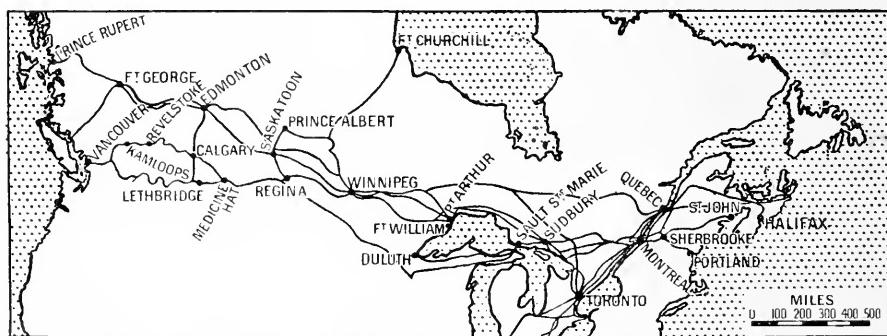


Fig. 60.—TRANSCONTINENTAL ROUTES OF
BRITISH NORTH AMERICA.

The three passes by which these main routes cross the Rockies are respectively from North to South :

- The Yellowhead Pass, 3738 feet high.
- The Kicking Horse Pass, 5329 feet high.
- The Crow's Nest Pass, 5500 feet high.

The first named being under 5000 feet is clearly marked on fig. 9.

the export coal trade of the lake ports of the United States. Name one or two of these ports. Note the positions on the railway of the coal towns of Lethbridge, Banff, and Cochrane, the latter between Calgary and the Rockies. In what parts of Europe have we found coal being mined on the mountainous border of a great plain?

British Columbia is well supplied with coal, the fields which are being mined probably forming only a small portion of its resources. Anthracite is mined in the

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Crow's Nest Valley, the pass through which the C.P.R. (Canadian Pacific Railway) crosses the Cordilleras, and also in the Nicolay Valley, while good bituminous coal is found in the Queen Charlotte Islands and on Vancouver.

Note the position of Nanaimo, the chief coal port on Vancouver Island. Why is it so valuable to the C.P.R.? Note also the position of the Nicolay Valley and that it is situated in what is called the "Railway Belt."

The Grand Trunk Pacific is being carried *via* the Yellow



Fig. 61.—CHIEF MINING REGIONS FOR GOLD, SILVER,
LEAD, AND ZINC.

Name some of the chief towns connected with the running of these minerals.

Head Pass and the southern source of the Fraser River over the Rockies to the mouth of the Skeena river at Prince Rupert.

What source of coal is near this terminus?

What other railway comes into British Columbia by the same pass?
Where is its terminus?

In a fully developed country like the United Kingdom

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a map showing the relative density of the population throughout the country is a fairly exact index to and is indeed determined by the character of the occupations of its inhabitants.

Look at fig. 66 and compare with figs. 59-65 and consider how far this is true of the Dominion. Study Table I in the Appendix and note which Provinces contain the bulk of the population. Do the same appear to be the most populous on the map? Note the large area of the North-West Territories belonging to Quebec and explain the discrepancy observed.

Do you trace any connection between the regions of densest popula-

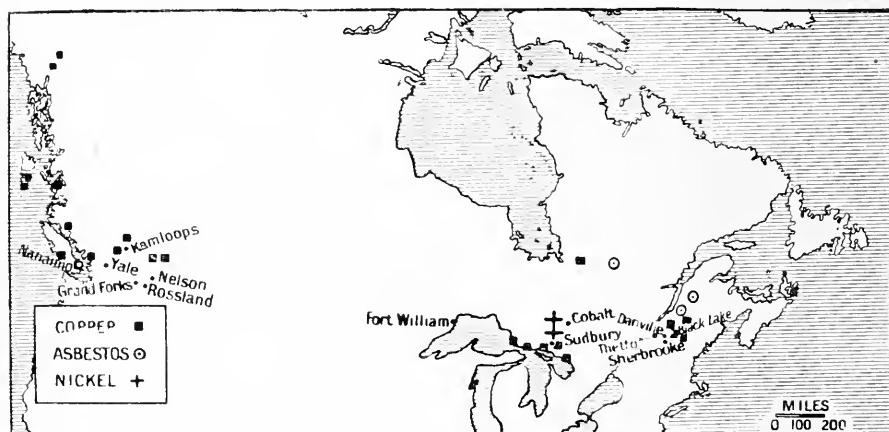


Fig. 62.—CHIEF MINING REGIONS FOR COPPER,
ASBESTOS, AND NICKEL.

Name some of the chief towns connected with these minerals.

tion as shown in fig. 66 and the situation of the main coalfields? To what extent does the question of accessibility to other parts of the world seem to have determined the regions of densest population?

Study carefully fig. 59, page 109, and name towns in Ontario, Quebec, and British Columbia situated where iron ore is found. Which of them are situated near coal supplies? Why is coal imported from the U.S.A. to Hamilton for the iron smelting trade? How is it brought over? Where is gold mined? (fig. 61). Which are the most accessible and which the least accessible of the gold deposits? How is it that gold should be mined in a

district so inaccessible as the Yukon and Klondike? How do you account for gold being found chiefly in the west and in the Archean region? In what class of rock is gold usually found, unless it is alluvial?

Which region of Canada has the most varied supply of minerals?

Ontario has certainly the greatest variety and, up to the present at least, the richest stores of minerals of all kinds, having both silver and copper mines, and the richest nickel deposits in the world. Quebec has also very valuable supplies of asbestos, whilst lime salts and building stones of all kinds are widely distributed in the eastern states.

You are now in a position to discuss the reason for the chief industries of certain regions of the Dominion and for the growth of the chief cities.

Nova Scotia, as we have already seen, contains some of the most densely peopled districts of the States (fig. 66).

How do you connect this with its mineral resources?

Some 70 per cent of the coal mined is from Cape Breton Island. Gold is mined in the districts lying on the eastern border, whilst further west some iron is mined.

Agriculture is the chief occupation, though the fisheries are also very valuable.

Consider the character of a large portion of the population and account for the great development of dairying.

Note the situation of the valley of Annapolis, noted for its apple orchards.

Note the position of the following towns:

Halifax—one of the chief winter ports of Canada, during the winter months in which the St Lawrence is frozen.

Trace its railway connections with Quebec and Montreal.

Sydney—as a coal shipping port.

New Brunswick, was once one vast forest, and lumbering is still its chief asset.

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Note the three chief rivers, the St John, the Miramichi and the Restigouche. Name the towns at the mouths of these rivers. Of what assistance are these to the chief industry? How does the factor of the climate also assist? Account, too, for the reputation that New Brunswick holds for hunters.

It is thus easy to account for the fact that in New Brunswick agriculture takes second place, in spite of the existence in the river valleys of exceedingly fertile strips known as Intervale lands.

What Bay is situated to the south of this country? What is its

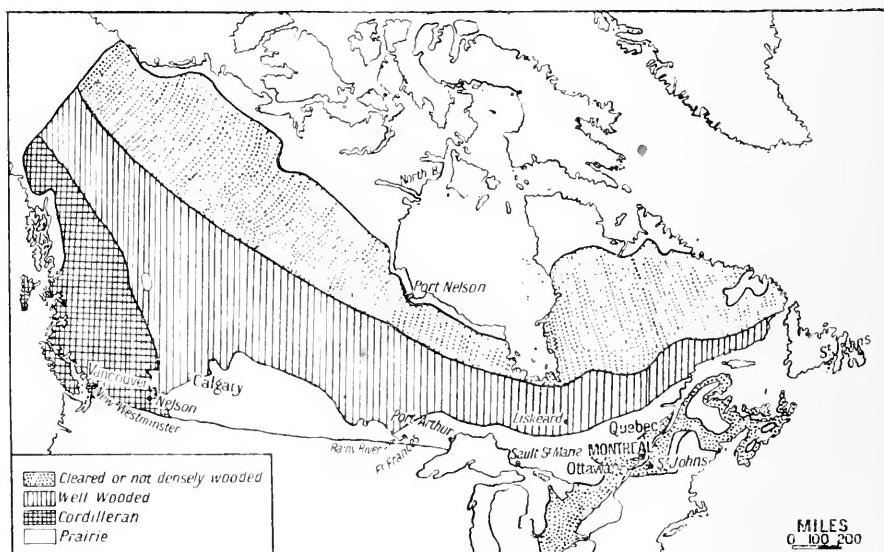


Fig. 63.—TIMBER LANDS.

shape? From which direction, a northerly or a southerly one, do the tides approach the British Isles and the North Atlantic? Recall the nature and cause of a bore and account for the bore of the Bay of Fundy, which is the greatest in the world.

Fishing occupies a large number of people in this State, as the Bay of Fundy affords a long stretch of coast and its waters never freeze.

Note the position of St John's and discuss its rivalry with Halifax as the chief winter port of Canada (fig. 60). Discuss the position

of Fredericton as the capital and Moncton as a railway centre.
Why are all the chief cities near the southern coast?

Prince Edward Island. It is somewhat difficult to explain the density of population of this comparatively small island.

Estimate roughly its length and breadth and compare with Iceland.
How would its position render it favourable for settlement?

Its climate, gaining for it the name of the garden province

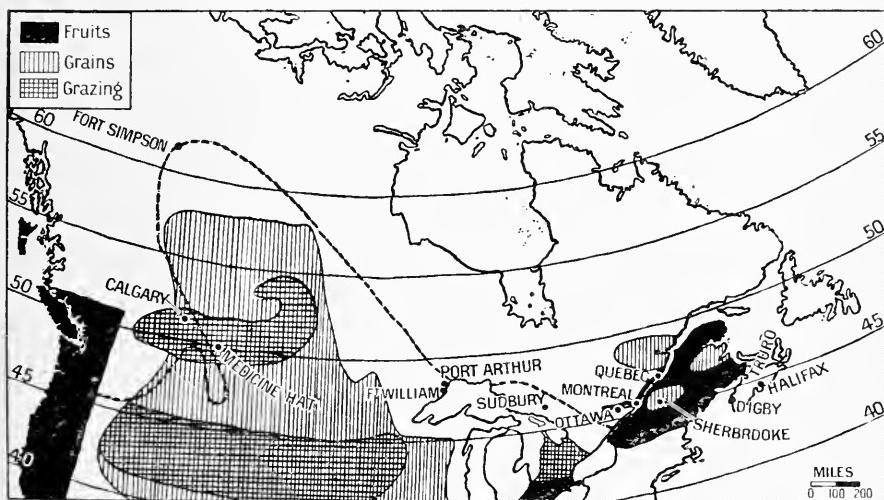


Fig. 64.—CHIEF AGRICULTURAL REGIONS.

and rendering it an ideal summer resort, must, however, be regarded as its chief asset. Of all the countries forming the Dominion its climate most resembles that of Great Britain, except that the ice of the St Lawrence mouth greatly delays the spring.

What island shields Prince Edward Island from the Atlantic fogs?

Its fertile soil, which can readily be enriched by fertilizing products of the sea (decaying fish and shell waste), makes agriculture its chief industry, along with, of course,

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fishing. Most of the agriculture is devoted to what one may call secondary production, *e.g.* bacon, butter, and cheese, just as we have previously classified steel and iron goods as secondary as compared with pig iron, clothes as compared with woollen yarn.

Note the position of Charlottetown and describe the nature of the bay upon which it stands. Connection with the mainland is maintained by ferries from Summerside and Charlottetown. Can you suggest why at certain seasons the ferry must travel from Georgetown to Pictou? In explaining this, recall first the influence of land and sea respectively upon climate, and discuss the reasons which determine how far out to sea the freezing of a river estuary is likely to extend. What would you conclude to be the influence of (a) tide? (b) salt water?

In which part of Canada does the spring first make its appearance and then progress most rapidly? At what season will ice, therefore, be carried furthest out of the river mouth and be most likely to cause a block?

Quebec, with a large proportion of its inhabitants still speaking French, is the original Canada of history.

As we have already seen, the winter is long and severe, but it is followed by a rapid spring and a summer so warm that even maize and tobacco can be grown.

Note the position of the city of Quebec on the high left bank of the river where the Laurentian plateau reaches the river. What event do you recall in history connected with the Heights of Abraham?

Transatlantic passengers here leave the steamer, though cargo is carried further up stream to Montreal (=Mount Royal), the deepening of the river channel having encouraged the more rapid growth of this city, which is situated on a rocky island in the river. In fifty years while the population of Quebec city has remained almost stationary, that of Montreal has increased between three and fourfold.

What may be the effect upon this of the much increased tonnage and draught of Atlantic liners and vessels?

Near Montreal are some of the finest apple orchards of Canada, but though the State of Quebec has its agriculture highly developed, especially in the St Lawrence belt, its products are largely for home consumption. The State, first in butter-making, is second only to Ontario in its

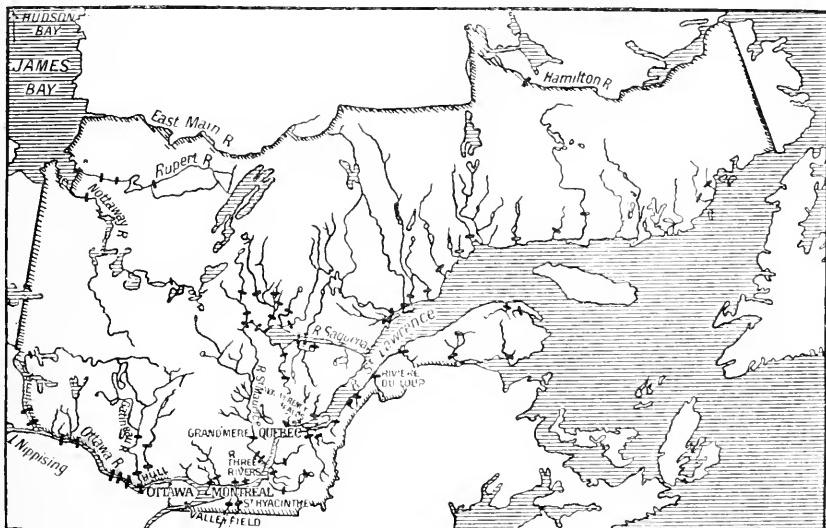


Fig. 65.—AVAILABLE WATER POWER OF QUEBEC.

The marks across the rivers indicate available water power. Every year sees a wider application of these vast resources of power, commonly called "white fuel."

cheese production, which latter is exported to Great Britain. Oats and hay are the most valuable crops, of which the latter is exported in considerable quantities to the United States.

Consider the character of the most accessible region of the United States. Is it industrial or agricultural? Account for this export.

Quebec is probably richly endowed with minerals, which, however, except for asbestos, are not yet much

developed. Quebec has a forest area covering over a hundred thousand square miles, and consequently lumbering in all this region takes precedence of mining.

Can you suggest a reason for this precedence ?

In which other State have we found this to be the case ?

We have referred already to the notable absence of coal, in spite of which, however, the State is second only to Ontario in manufactures.

Note the large number of tributaries on the left bank of the St Lawrence and, recalling the steep character of this bank, suggest what form of power is readily obtainable (see fig. 65). Discuss the fact that Montreal is the busiest manufacturing city of the State. Note the advantageous position of Three Rivers and Sorel. Why should Valleyfield be able to specialize in textiles and paper? What is the connection between lumbering and paper-making? With what other requirement for paper-making is Quebec well provided?

Discuss the industries and the situations of the following towns : *Leather goods*, Montreal, Quebec, and St Hyacinthe.

Textiles (cotton and wool), Valleyfield, St Hyacinthe, and Sherbrooke.

Tobacco and cigars, Quebec and Montreal.

Paper and Wood-Pulp, Hull, Grand Mère, Valleyfield, St Hyacinthe.

Iron, Montreal, Three Rivers, Sherbrooke, Sorel. (Fig. 59.)

In each case discuss also the home-supply or other source of the raw materials necessary.

Ontario. In studying in greater detail the important State of Ontario, we find that it consists of two distinct regions, namely, the triangular peninsula of Southern Ontario lying to the south of Lake Nipissing, and Northern Ontario.

What three great lakes and two rivers form the boundaries of Southern Ontario? What river and sea form the northern boundary and what great lake the southern boundary of Northern Ontario?

Note the lake character of the country. With what factor in the geological history of the country do you connect this?

These two regions are geographically distinct not only as to position, but as to structure, climate, and industrial importance.

Southern Ontario has a fine clay loam soil, unequalled for fertility, so much so in parts that the region lying to the south-west, between the falls of Niagara and Lake Huron, is often called the Garden of Canada. As we have already said, the Laurentian Highland, which occupies a

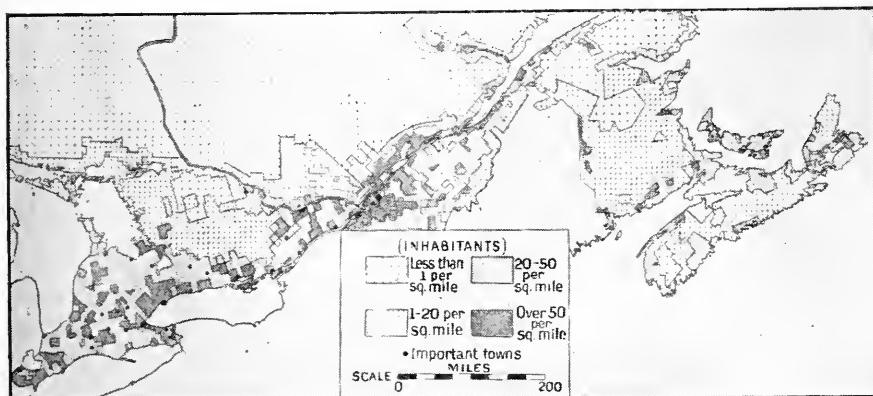


Fig. 66.—POPULATION MAP OF THE EASTERN STATES.

Name some of the chief towns marked in the above map. Compare with figs. 59 to 62 and show to what extent increase of population is due (a) to accessibility to waterways; (b) to the presence of minerals.

part of Northern Ontario to the north of Lake Superior, is a much denuded land, but it has many fertile valleys besides its lakes and marshy swamps, the latter known as *muskegs*. From the highest point of the Laurentian Hills which form a divide roughly parallel to the northern shore of Lake Superior and part of the Height of Land, the country slopes away to the Hudson Bay. This at present is a much timbered belt, but it is hoped that it will later prove a good grazing region, for its low altitude and the nearness of the Hudson Bay give it a moderate climate.

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Discuss the effect of the lakes upon the climate of different parts of Ontario, which in its southern part has a much milder climate than Quebec and is only liable to extreme winter conditions on the Laurentian plateau.

In agriculture wheat is only grown for home consumption, as the chief occupation is dairying, more cheese being exported from Ontario than from the whole of the United States.

Why should stock-raising, and pork and bacon curing be natural accompaniments of dairy-farming? Upon what are pigs fed? Compare the small production of wheat with that of the great wheat regions of Western Canada and discuss the reason. Discuss which part of Ontario is the best fruit-growing region.

Why is Southern Ontario no longer a lumbering region, while Northern Ontario is still one vast forest? Compare carefully the mining map of Ontario with the lumbering map of Canada. What principle is again shown in this case?

Note the distribution of the following natural products and the situation of the chief towns connected with them (see figs. 59-64):

Iron smelting, Hamilton, Deseronto, Sault Ste. Marie.

Nickel and Copper, Sudbury.

Silver, Cobalt.

Petroleum and Natural gas are found in the narrow peninsula between Lakes Huron and Erie.

Note and discuss the value of the positions of:

Toronto, the capital of the province and a most important distributing centre.

Ottawa, the capital of the Dominion, situated on the Chaudière Falls. Why has the city such fine saw-mills?

Belleville and Woodstock, exporting towns for cheese.

Fort William, at the head of navigation, has huge grain elevators and flour mills. Why? In which direction is the grain being carried?

Port Arthur has a similar position and importance.

Manitoba.

Discuss in connection with what you have already learned as to the climate of this region, the fact that farming and wheat-growing are the chief industries. Why is fishing also of importance in Manitoba? Name some of the chief lakes. Discuss the position

of Winnipeg (a) as the capital, (b) as a railway and distributing centre.

What does the occurrence of deposits of gypsum (calcium sulphate) in this region suggest as to the original disposition of the lakes? What other conclusions can you come to as regards the geological history of the south-western region from the presence there of soft coal? Note the position of Winnipeg, the chief distributing centre of the province. Account for its large stock yards, flour mills, and engineering works. With what railways are these last-named connected? Note the position of the following towns in connection with the industries named:

Brandon, flour milling.

Portage la Prairie, with large grain elevators and flour mills.

Selkirk, flour mills, saw-mills, and fish cold storage.

Saskatchewan (rushing water).

Name the chief rivers of this district. From what region does the Saskatchewan derive most of its waters? At what season of the year does it become a "rushing water"? Why?

Which portions of the State are respectively concerned, (a) in fur trading? (b) in lumbering? (c) in farming? (d) in coal? (See maps 59-64.)

Account for the grain elevators, flour mills, and machine shops of *Regina*, the capital.

Note the positions of the following towns in connection with their industries:

Moose Jaw, a great trade and railway centre. With what part of the United States does it connect? (See fig. 60.)

Prince Albert, a lumber town—also a river port for furs. (See fig. 63.)

Alberta. As we travel westward the valleys of the rivers get much deeper, those in Alberta flowing in places some 300 feet below the level of the prairie. Into these deep river valleys there run at right angles deep, narrow, dry ravines, that penetrate far into the land and are known as *coulées*.

Study the contour map (fig. 52) and account for the greater depth of the western river valleys.

What changes in climate must this region have undergone?

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Explain why the winter of Alberta is much milder than that of Saskatchewan. To what wind is it due?

Note the position of the following towns in connection with their industries:

Edmonton, the capital, a great centre for trade, flour milling, and also furs.

Calgary, railway centre, live stock, milling.

In the region to the west of Calgary ideal geological conditions have been found for the production of petroleum, and considerable boring is being undertaken there. Oil-bearing shale covered with layers of impervious rock are found along the foothills of the western Rocky Mountains and they are sufficiently contorted to form springs.

Recall the structure of an artesian well and discuss how the contortion of strata is an advantage to the obtaining of oil.

Medicine Hat, coal and natural gas. (Fig. 59.)

Lethbridge, coal, and a railway centre.

Canmore, anthracite.

Note the position of the coal towns relative to the railways.

British Columbia.

Account for the existence of moist and dry belts. Why do they lie roughly north and south?

Name the chief rivers. How do they flow?

Which are the chief coal towns of the province? How do they lie relatively to the railways?

Note the positions of the following towns in connection with their chief industries (see figs. 59-64):

Victoria, the capital, with a large ocean and coast trade.

Vancouver, the chief commercial city, a centre for lumbering.

New Westminster, salmon canning and lumbering.

Nelson, fruit-growing, lumbering and mining.

Rossland, mining, iron, copper, gold and silver.

Trail, smelting of lead and silver.

Fernie, chief coal mining centre.

Measure carefully the length and breadth and compare it roughly with the size of Ireland or Wales.

The Yukon District.

What main river drains this district? Through what country and into what sea? What town lies at the confluence of the Yukon

and the Klondike? Account for its extremely cold winter climate, and its very short summer. Can you explain the compensating circumstances by which it is possible to grow garden vegetables during this very short summer? (See fig. 58.)

As in the corresponding and neighbouring State of Alaska, gold-mining is the chief industry, though the placer mines of Dawson City are now being worked out. Coal and copper are plentiful though as yet little worked, the latter round Whitehorse at the terminus of the White Pass and Yukon railway.

Along what rivers do travellers from Skagway to Dawson pass after leaving the rail at Whitehorse? By what other route can travellers from Dawson reach the coast in summer? Why should the Skagway route be preferable to Canadians? Why has the opening of this route added to the trade of Vancouver?

North-West Territories. This vast area of nearly two million square miles consists of a northern belt of barren lands and a southern belt of forest regions, mostly of spruce fir. As yet no valuable minerals have been discovered. The chief settlements are the trading stations of the Hudson Bay Company.

Account for the trade in furs. Name a future industry of these regions. Can you suggest why the timber has not as yet been cut? Spruce is mostly used for wood pulp.

Newfoundland, though not a part of the great Dominion of Canada, demands a certain amount of special study.

Make a map study of the island. How far is it from the Labrador coast and from Cape Breton Island? What is its greatest length (a) from north to south? and (b) from east to west? How does it compare in size with Ireland? What is the general elevation of the country, also its greatest elevation?

It is found that the surface of the country is irregular, the hills are near the coast and the country itself is both

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barren and marshy. There is not much fertile land except in the valleys where the hardier cereals and vegetables are grown.

What is meant by the hardier cereals? Can you suggest a reason for the absence of wheat cultivation?

As a matter of fact, the climate is so very insular that while on the one hand no frost is as a rule experienced in the winter, the summer temperature seldom rises above 80° F.

Why is the east coast cooler than the west? To what current is it due? What other influence do the currents of this region exert upon the climate? What danger is caused to navigation? Note the situation of the Grand Banks. To what industry has this great submarine plateau given rise? Compare with the Dogger Bank. What is derived from the cod of Newfoundland?

Sealing and lobster-canning are also important industries. Excellent iron ore is mined and considerable quantities are exported to Nova Scotia, though Newfoundland has coal of excellent quality, as also copper ore. Argentiferous lead and gypsum are also found.

How do you connect the finding of gypsum with the presence in the country of inland lakes and saline marshes?

Note the position of the capital, St John's, Harbour Grace, a fisheries dépôt, and Heart's Content, the terminus of several Atlantic cables.

Newfoundland was one of the first countries of British North America to develop the wood pulp and paper industry, especially for export to Great Britain.

Suggest a reason for this precedence? What is likely eventually to put a limit or an end to this industry?

QUESTIONS AND EXERCISES

- (1) Trace or draw a sketch map of the St Lawrence basin, marking
 - (a) the positions of the chief industrial towns and river and lake

- ports, (b) the chief lake ports of the United States, and (c) the reaches where canals have had to be constructed.
- (2) Draw rectangles to represent the area and population of British North America, Quebec, and Saskatchewan, scale: 1 sq. mm. = 1000 sq. miles and 1 sq. mm. shaded = 500,000 inhabitants. Compare with those of the United States and United Kingdom drawn to the same scale. Draw Manitoba on the same scale as New York State (1 sq. nm. = 100 sq. miles; and compare with the States and counties already drawn to that scale. What do you conclude as to the extent of the development of the State of Manitoba?
- (3) Draw rectangles to compare the import and export trade of British North America with those of the United States and the United Kingdom respectively, to the same scale as in Question 7, Chapter V. (See Appendix, Tables II and III.) Compare these countries as to the relative value of their total trade per head of population.
- (4) Draw thick lines to a suitable scale to compare the number of domestic animals in British North America with the number in U.S.A., U.K., and France respectively. Use the same scale as in Question 9 Chapter V. (See Table V.)
- (5) Look at the table of cereals (Table IVa) in the Appendix. How does British North America compare with U.S.A., U.K., and France (a) as to total wheat production? (b) wheat production per head of population (calculate from Tables IVa and I)? (c) as to the production of other cereals? How far are these determined by climatic considerations?
- (6) Examine Table IVb and note the chief agricultural products of British North America other than cereals. What kind of sugar is produced in Canada?
- (7) How does British North America compare with other countries of North America in its mineral products? Where does it stand in the production of (a) gold, (b) silver, and (c) coal? (Table VII.)
- (8) Trace the chief contours from the contour map and mark on this outline the chief transcontinental railway routes, noting the three passes by which the Western Cordilleras are crossed.
- (9) When it is noon at Greenwich what is the time at (a) Montreal? (b) Medicine Hat? (c) Vancouver? What is the difference, if any, between local time as shown by longitude and standard railway time at any of these towns? (See fig. 8.)
- (10) Study figures 59-64 and make lists of the towns which respectively are (a) railway centres, (b) sea, river, or lake ports, (c) mining towns, (d) agricultural or lumbering centres.

CHAPTER VII

MEXICO

Study carefully the accompanying contour map (fig. 67) and compare it with a map of North America. What is the situation of Mexico? Between which parallels of latitude does it lie? Be-

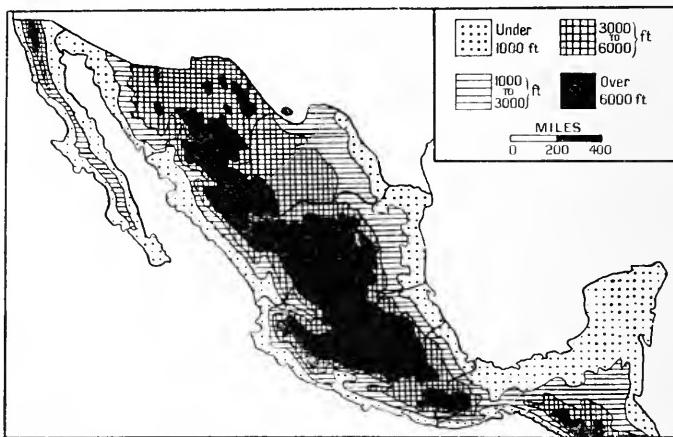


Fig. 67.—CONTOUR MAP OF MEXICO.

tween which meridians of longitude? Name and describe its boundaries. Which are natural and which artificial? How does the northernmost latitude of Mexico compare with that of the most southerly countries of Europe? How does the country lie relatively to the Tropic of Cancer? What sort of climate would you thus expect for this country? What is the character of the elevation of Mexico? Make two E. and W. elevations from fig. 67, one approximately through Mexico City and the other through the mouth of the Rio Grande. Is the bulk of the land of high or of low elevation? What will you expect to be the influence of the structure of this country upon its climate?

Thus we see that Mexico consists chiefly of a southern

prolongation of the western Cordillera region of North America, with the result that the average elevation of the whole country is high. The central region is a high, rugged plateau averaging some 6000 to 7000 feet in height, reaching to 8000 feet in the States of Mexico and Puebla. This plateau is bounded by high marginal mountain chains and is crossed by rather lower ridges, sufficiently elevated to form a water parting between the northern and southern slopes of the plateau. To the east and west the plateau falls away rapidly to the coast, forming thereby a serious obstacle to the construction of railways and other means of communication. To the south and north-east the plateau falls more gradually and, especially in the latter case, forms a series of terraces which provide some of the most fertile regions of the country. Between the high plateau and the coast lies a lowland region. Near the mountains this affords a fertile belt rising to an average elevation of some 3000 feet and consisting of the débris of the great Sierras themselves. This gives place to a low-lying sandy belt along the shore-line.

Comparing with North America generally, on which coast would you expect this low-lying belt to be wider? How would you connect your observation on this point with the formation of the Gulf of California?

So high is the average elevation of the country, and so great is the difference in elevation between that of the bulk of the country and that of the coastal plain, that it becomes the chief factor to be considered in discussing its climate.

What is the influence of elevation upon climate (a) in the winter? (b) in the summer? Look at figs. 18 and 19 and assuming a fall of 1° temperature for every rise of 300 feet, what are the average winter and summer temperatures respectively of Mexico

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City? How do they compare with those of (a) New York? (b) Vera Cruz? Exact elevation of Mexico City=7500 ft.

Thus roughly corresponding to the three regions of highland and lowland there are three climatic zones, as follows:

Tierras Calientes (Hot lands) stretching from the coast to a height of about 3000 feet.

Tierras Templadas (Temperate lands) reaching to some 5000 feet and Tierras Frias (cold lands) from 5000 to 8000 feet. Study figs. 67 and 68 and note the elevation of the different regions.

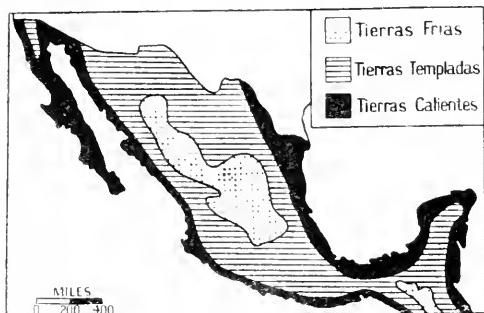


Fig. 68.—CLIMATIC REGIONS OF MEXICO.

Compare with fig. 67.

hogany being two of the most important natural products, and coffee the chief product of cultivation.

The Tierras Templadas—though the name implies temperate region—are really sub-tropical with a mean annual temperature of some 75° F., while the Tierras Frias correspond rather to the temperate regions of our own continent, suitable for the cultivation of cereals and for grazing and forestry, and are regions where frosts are rarely experienced. Above these are colder regions, the snow line, however, not being reached till a height of some 15,000 feet.

Find the peaks of Popocatepetl (smoking mountain), Ixtaccihuatl (white woman), and Orizaba, each of which is over 17,000 ft. high.

We have already noted between what latitudes Mexico lies and therefore we shall expect to find its climate, apart from the variations which we have already noted as due to differences in altitude, to be tropical in character.

What have you learned as to tropical climates? What seasons are characteristic of them? How do they differ from the seasons of temperate regions? What name is given to these seasons?

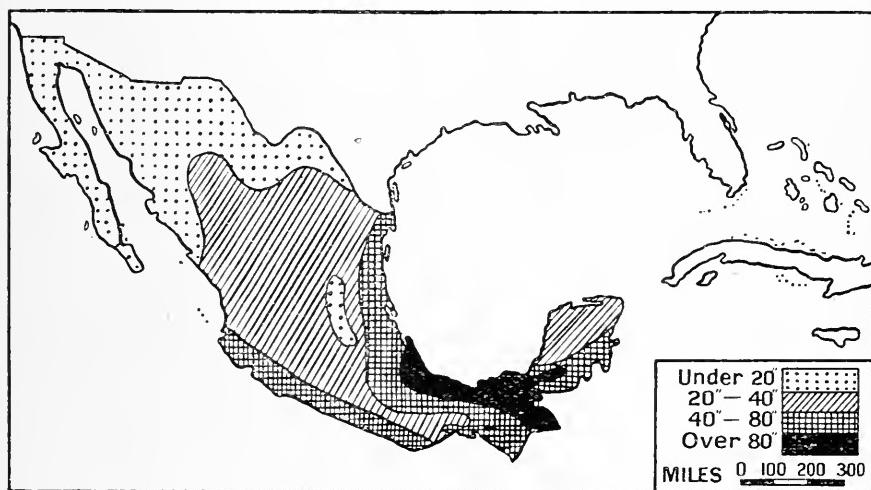


Fig. 69.—ANNUAL RAINFALL.

By tracing this map and placing it over fig. 71 discover the approximate rainfall of Mexico City, Vera Cruz, and other cities of this State.

Whence is the name derived? Look at the seasonal maps of rainfall of America (figs. 21 and 22) and discover in which season the rainfall is least and in which most. How does your observation agree with what you have learned as to the sun's elevation and the rainfall?

The distribution of this seasonal rainfall throughout the country is as usual determined by the prevailing winds and by the lie of the land, *e.g.* land relatively to sea, and mountains relatively to sea and prevailing winds.

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Study figs. 21 and 22, compare them with figs. 3 and 4 and account for the positions of the regions of greatest and least rainfall respectively.

The relative length of the dry and wet monsoons respectively varies greatly, not only in countries in similar latitudes, but also in different parts of the same country. So great may be this variation that a tropical country with an oceanic position may have a comparatively even distribution of rain throughout the year, though its monsoon character will still be marked by a periodic alternation of maximum and minimum rainfall.

Study the following figures showing monthly rainfall and monthly average temperature in Colima (Pacific coast), Zacatecas (inland),

	Colima		Zacatecas		Vera Cruz		Matamoros	
Latitude .	19° 12'		22° 58'		19° 12'		25° 49'	
Height above Sea-level .	1500ft.		7600ft.		45 ft.		170 ft.	
	Temp. °F.	Rain-fall inches	Temp. F.	Rain-fall inches	Temp. F.	Rain-fall inches	Temp. °F.	Rain-fall inches
January .	69.5	.5	52	.9	71.4	.4	62.6	1.6
February .	70.5	..	53.3	.4	73.2	.5	63.9	2.3
March .	73.9	..	57.2	.9	74.8	.6	68.4	2.4
April .	76.8	..	62.4	.5	78.9	.1	73.9	2.2
May .	80.6	.7	63.7	.5	80.9	4.3	79.3	3.6
June .	80.9	6.8	64.8	4.9	81.5	12.5	81.9	3.6
July .	79.7	7.2	62.0	5.2	81.7	14.8	84.2	2.3
August .	79.5	6.7	62.4	3.9	81.7	8.9	84.2	2.3
September	78.1	7.4	60.6	3.1	80.4	11.6	81.1	7.0
October .	77.4	4.1	59.4	1.4	76.5	9.0	75.4	4.5
November	74.8	.5	55.8	.5	74.8	3.2	68.4	4.5
December	72.3	.3	52.2	.3	70.8	2.0	63.5	2.2

Maxima and minima in underlined type.

From the above figures, show the influence of altitude upon climate.

On which coast is the temperature liable to the greater amount of fluctuation ?

MEXICO

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and Vera Cruz and Matamoros (Atlantic coast). On the same plan, for each place draw both a temperature curve and a rainfall curve. Mark the months horizontally, and to suitable scales the temperature and the rainfall vertically. How does the temperature line behave relatively to the rainfall line in the case of (a) Colima ? (b) Zacatecas ? (c) Vera Cruz ? and (d) Matamoros ? What similarities and differences do you note between these places as regards (a) temperature ? (b) rainfall ? (c) monthly

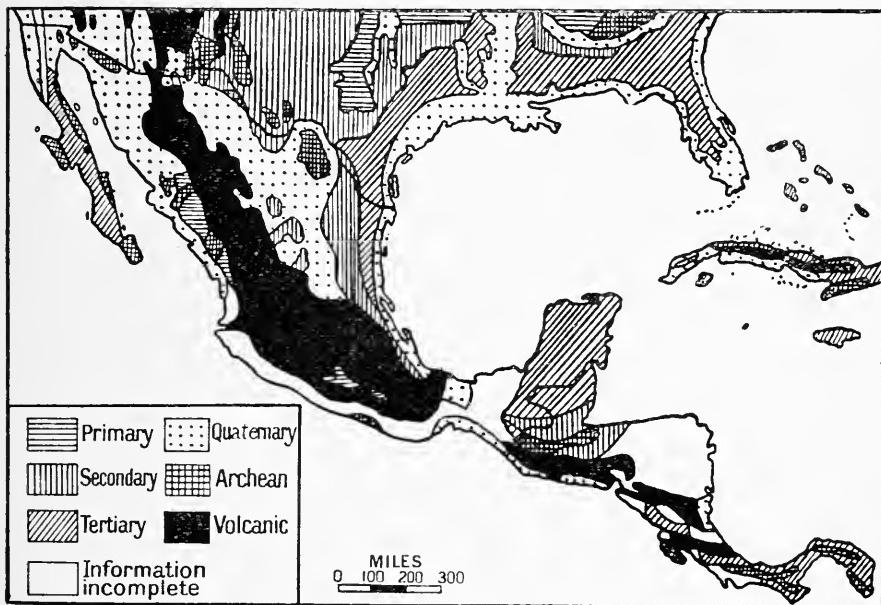


Fig. 70.—ROUGH GEOLOGICAL MAP OF MEXICO.

Compare with figs. 71 and 72, and note the positions relative to geological structure of the petroleum, coal, sulphur, and other minerals. Note from the atlas the situation of the chief volcanoes.

distribution of temperature and rainfall ? Look at figs. 3 and 4, and explain what part the trade winds play in causing any of these similarities and differences.

This fluctuation is a result of the periodical shifting of the region of minimum pressure from north to south of the equator, which is accompanied by a consequent reinforcement of northern winds into the Gulf of Mexico.

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What effect have we found these Norther to have on the crops of Florida?

No tropical region of the world is liable to so cooling an influence as that which the east coast of Mexico derives from the so-called Nortes.

Explain how these winds increase the rainfall and how the west

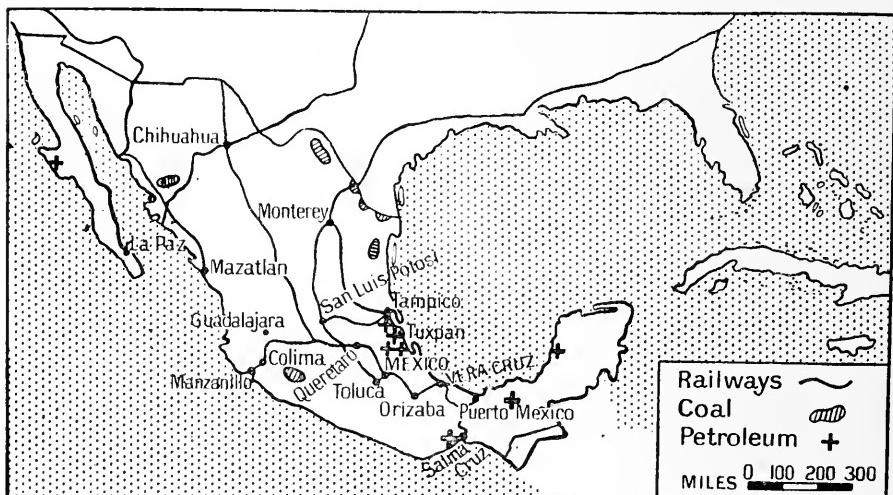


Fig. 71.—RAILWAYS AND FUEL RESOURCES OF MEXICO.

Trace this map and compare with fig. 67. Note the elevation to which the railways have to be carried.

coast is protected from them. Discuss the influence of the Nortes on the climate of Matamoros (see Table, p. 130).

It is possible now to explain why irrigation is often necessary in the tropics, not merely in arid regions but also in those which have a heavy rainfall during the wet season.

How is the variation in the bulk of the rivers affected by the presence of snow-capped peaks and glaciers at the sources of the rivers?

How may parts of Mexico be affected by the fact that it does not possess a large mountain region above snow-level?

The soil of Mexico is very largely volcanic in origin,

the three highest peaks already mentioned being extinct, or perhaps dormant volcanoes, for the whole country is liable to severe earthquakes, and it is only in comparatively recent times that Popocatapetl has belied its name (smoking mountain) by ceasing to smoke (fig. 70).

In spite, however, of the large area of volcanic deposit, very valuable mineral deposits are widely distributed,

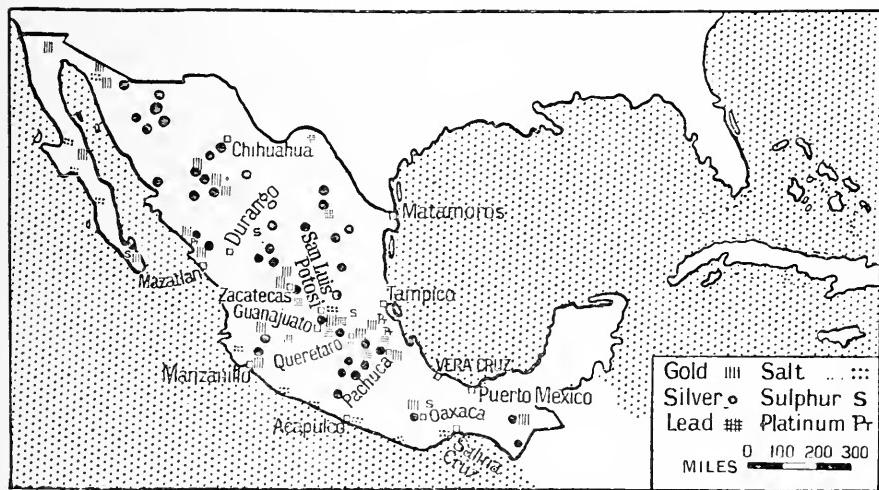


Fig. 72.—MINERAL RESOURCES OF MEXICO.

especially along the lines of greatest upheaval, and in some of the very ancient mountain groups which lie athwart the plateau. Of these, the most important is perhaps a lead ore containing a high percentage of silver. Gold and copper are also found in some of the same regions. Though the bulk of the remainder of the rocks are tertiary or cretaceous, carboniferous rocks supply coal, poor in quality though ample in quantity, the chief coal mines being in the north near the Sabinas River. On the other hand, large quantities of iron ore of high quality exist in the Sierra Madre (see figs. 71 and 72).

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Discuss the situation of the sulphur trade of Puebla—the iron trade of Durango, the silver trade of Zacatecas, Guanajuato, Catone, S. Luis Potosi, and Pachuca, the opal industry of Queretaro, the coal regions of Sabinas, of the Rio Yaqui and the eastern coal and petroleum fields in the hinterland of Tampico (figs. 71 and 72). To what extent are these industries placed advantageously (a) to one another? (b) to the ports?

As may be imagined, this wonderful country with its varied elevations, its abundant coastal rainfall, and its

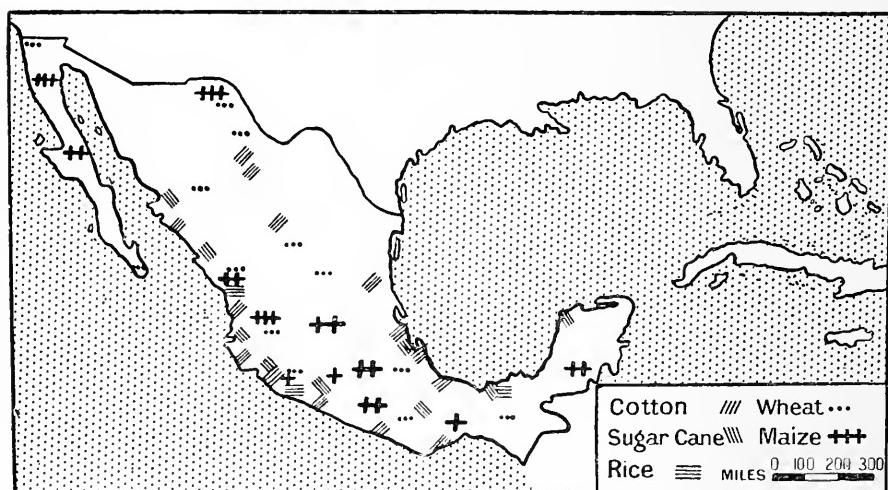


Fig. 73.—CHIEF AGRICULTURAL PRODUCTS OF MEXICO.

Compare this map by tracing, if necessary, with figs. 67, 68, and 69, and discover what parts respectively, elevation and climate play in Mexico in determining the distribution of these products.

moderate rainfall upon the plateau, affords opportunity for the growth, native or cultivated, of almost every product useful to man.

On the plateau wheat, barley, Indian corn, and forage crops are grown, but on account of the deficiency of rain which sometimes occurs, these crops, except in comparatively small regions where irrigation is possible, are liable to fail. Stock raising and sheep grazing are, however,

possible, especially on the borders of the plateau, so that while during the rainy season the higher pasturages afford excellent grazing, the cattle can be brought down to the lower moister regions during the dry season when the upper pastures become quite barren. It is, however, in the varying regions of the Tierras Calientes that the great vegetable wealth of the country is produced. This includes vast forests of most valuable trees, mahogany, logwood, rosewood; and ebony; rubber; cotton; almost every conceivable kind of tropical fruit, coffee, and finally the agave plant, which in one species or another affords either a fibre (henequen or sisal hemp, so called from Sisal, the original chief port of export), or a sap which is made by the natives into an intoxicating drink.

What two commercial products are obtained (a) from flax? (b) from cotton?

Just as with flax, a different method of cultivation is required according to which of its products is most required, so with the agave different species are cultivated for sap and fibre respectively.

Mexico City, the capital, is situated on the site of the ancient capital of one of the oldest civilized peoples of the world, the Aztecs. It lies at an elevation of 7500 feet in a depression in the plateau which at one time must have been a vast lake, but is now reduced to a number of smaller ones. The drainage system of the city and the overflow of these lakes is now carried off by a special canal some forty miles long, tunnelled for some five or six miles through the mountains.

How is the city supplied with railways? How is it connected (a) with the United States? (b) with the chief ports of Mexico? Name the ports on each coast. Note the position of Guadalajara and Puebla.

The chief ports of Vera Cruz and Tampico on the shallow eastern coast have had to undergo a considerable amount of improvement and dredging to permit of access for modern sea vessels.

Compare the railway and contour maps (figs. 67 and 71). Discuss reasons to account for the fact that the splendid natural harbour of Acapulco has not yet been developed. Can you suggest reasons why a railway extension to this port has been so long delayed? What do you imagine will be the effect of the opening of the Panama Canal? Note the positions of Salina Cruz and Coatza Coalcos, comparatively new ports fitted with the most modern appliances. How are they connected (a) with one another? (b) with the rest of the country?

Account for the position of Monterey as a steel and iron town and engineering centre.

QUESTIONS AND PRACTICAL EXERCISES

- (1) Draw rectangles as before (see Chapter V, question 6) to represent the area and population of Mexico: scale 1 sq. mm. = 1000 sq. miles and 1 sq. mm. shaded = 500,000 inhabitants. See Table I.
- (2) Examine carefully Table II of the Appendix. Using the same scale as in Question 7, Chapter V, if a base of $\frac{1}{2}$ cm. is used instead of one of 5 cm., each mm. in height of the rectangle so constructed will represent £1,000,000 of trade. Make out such a rectangle, dividing it to show (a) the total trade of Mexico, (b) the imports and exports respectively, and (c) by black shading, the portion of each trade with Great Britain.
- (3) Construct another rectangle on a similar scale to show the total value of the exports of Mexico, shading and labelling that portion of it which consists of minerals, silver, gold, copper, and other ores.

What do you imagine is the nature of the mineral import of Mexico? With what mineral is the country not too well supplied?

- (4) Study Tables I and IVa and IVb, and compare the United Kingdom, United States, British North America, and Mexico as to the area laid out in cereals relative to the size of the country, e.g. number of acres per square mile. How do they compare with one another in the yield per acre of wheat? Compare also the United States and Mexico in the yield per acre of maize. What factor in the climate of Mexico explains the growth of such a cool temperate cereal as barley in Mexico? In which region of the country is

it grown? What other agricultural products are yielded in Mexico?

- (5) How does Mexico compare with other countries in the number of domestic animals (for food and transport respectively) per head of population? See Table V.
- (6) Contrast your observations from Table V with Table VI and note whether Mexico is more of a cattle-rearing than an agricultural country. Which is the more likely to be the case in a mining country? Why is grazing more profitable in an industrial and mining region? How is it dependent (a) upon the food requirements of the non-farming population? (b) upon the high value of labour? In answering *a* consider which is easier to import from abroad: cereals or dairy produce; and in answering *b* consider which demands more labour: cattle rearing or agriculture.
- (7) Of which metal does Mexico produce the greatest quantity? (Table VII). Draw rectangles to a suitable scale to compare the output of silver in Mexico with that in the United States and British North America. How does Mexico compare with the United States and British North America in the production of copper, lead, and zinc?
- (8) How does Mexico compare with other American countries in railway development? See Table IX.
- (9) Study carefully the following table showing the chief purchasers of Mexican products (expressed in approximate percentages of the total production or export).

	Gold	Silver	Copper	Lead	Coffee	Rubber	Sugar
United States .	84	78	86	60	53	87	×
United Kingdom	5.8	14	5	22.5	8	×	over 99
France . .	x	x	9	12	18	4	..
Germany . .	..	2	..	4.5	18	5	..
Belgium . .	x	5	x	x	x	3	..

x = less than 1 per cent.

Which country is Mexico's best customer? How is this borne out by reference to Table IIIa in the Appendix? How does trade with Great Britain in each article stand (a) in reference to the United States? (b) in reference to the other European countries? Suggest reasons (a) for the predominance of the United States in Mexican trade, (b) for the small amount of rubber and coffee exported to Britain. In answering these latter questions consider the position of Mexico relative to the United States and also its competitors for rubber and coffee in the London markets.

CHAPTER VIII

THE CENTRAL AMERICAN STATES

Study carefully the map of Central America in the atlas. Name the States and describe the boundaries between them. Compare the map with the contour map (fig. 74) and note the general configuration of the land. Are the Andes continuous with the Rockies? Where do the Rockies end? Do the Andes extend

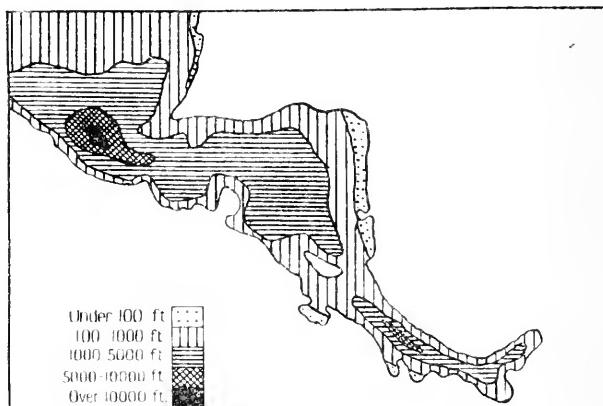


Fig. 74.—CENTRAL AMERICA CONTOURS.

into the Isthmus? Where are the lowest gaps across Central America? Where is the Isthmus at its lowest? Compare with the geological map fig. 70, and note to what extent the mountains are volcanic. Which of the countries have (a) no eastern coast, (b) no western coast? Which have coasts on both sides? Arrange the States roughly in order of their area—the three larger and the four smaller states. Compare roughly the area of British Honduras with that of Ireland, or Wales.

We have throughout our geographical studies considered each portion of the world from a human rather than from a purely scientific point of view. To what

extent are the countries under consideration a suitable home for man? If densely inhabited, by virtue of what geographical factors is the population able to support itself? If not densely populated, why not? Is it due to inaccessibility or to barrenness?

Recall instances. Name well populated regions or countries dependent (a) on their mineral resources, (b) on a climate and soil suited to agriculture. Name a region too barren to support a population.

On the other hand, we have seen that men inhabit regions in spite sometimes of the greatest geographical obstacles—generally in order to be able to make use of some unique or otherwise valuable resources of the country.

In no part of the world is this true in so many ways as in Central America. With climatic conditions which have produced some of the most fever-ridden swamps of the world, which also give rise to the most sudden and destructive of storms, with the constant uncertainty and insecurity belonging to a region which has known some of the most violent volcanic eruptions and where earthquakes are so frequent that the inhabitants of one capital after another have had to seek a fresh and more suitable site for their home—with all these natural geographical obstacles to contend against, it is far more a matter for wonder that this part of the world is inhabited at all than that its vast resources should be, comparatively speaking, so little developed.

In studying in some detail the climate of Central America we find very interesting examples of the various influences affecting climate.

How do these States lie relatively to the equator? What is therefore the general direction of the prevailing wind of this region? (see figs. 3 and 4). Which parts of Central America are exposed

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to this wind? Which parts are protected from it? What happens to the N.E. Trades when the sun moves to its northern limit? Over what countries does the sun shine vertically as it thus passes northward?

We thus see that in the northern summer a barometric minimum tends to be established over northern Central America.

How will the wind tend to blow relative to the region of barometric minimum? In the northern Hemisphere what happens to winds blowing from north to south and to those blowing from south to north?

Thus we find that this monsoon condition causes on the Pacific coast a south-west monsoon wind which, blowing off the sea, brings the wet season on that coast. On the Atlantic coast, on the other hand, it merely causes a continuance of the north-easterly trade wind of the rest of the year.

Examine the accompanying table and explain the even distribution of rainfall on the Atlantic coast as compared with the June to October rainfall on the west coast.

		Greytown, Nicaragua. Rain, inches	Temp.	Masaya, Nicaragua. Rain, inches
January	23.3	77.5° F. .2
February	11.3	77.7° .2
March	6.5	78.8° .2
April	11.4	80.8° .3
May	20.3	80.8° 5.3
June	23.2	80.1° 10.9
July	34.4	79.2° 6.5
August	27.3	79.3° 6.8
September	17.4	80.4° 9.1
October	20.0	80.3° 10.8
November	36.4	78.4° 2.0
December	27.8	77.6° .4

Note the position of the mountains which protect the Pacific coast near Masaya from November to April from the N.E. Trade Winds.

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Having regard to this high rainfall on the east coast and to the average temperature in these latitudes, discuss the character of the resultant climate and account for its exceedingly sultry character. Compare the Pacific with the Atlantic seaboard. Which has the longer coast? To which coast do the mountains lie closer? Which has therefore the flatter, shallower coast? On which coast are the rivers short and steep? On which coast lie lagoons and salt-water lakes? Find the chief inland lakes.

The soil, largely volcanic ash, is of a light and productive character and as a result the country mainly consists, especially on the eastern side of the mountains, of dense tropical jungle and forests.

In what respect is the climate of the eastern seaboard especially suited to such growth?

The chief products of the Central American States are among those typical of tropical regions and fall into the following groups:

Forest products—*special timber* such as mahogany, *lignum vitae*, rosewood; *dye woods*, e.g. logwood; *barks*, and other vegetable products collected for their medicinal properties, e.g. cinchona for quinine, aloes, sarsaparilla; *native rubber*.

Cultivated products — including bananas, coffee, tobacco, vanilla, indigo plant and sugar; rubber is nowadays also cultivated.

All the States of Central America, except British Honduras, are republics, and the development of most of them has been greatly retarded by bad administration. In all of them, as in Mexico, there are climatic zones dependent upon elevation, the most populous regions being the plateaux of upwards of 2000 feet in height.

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Make a careful map study of the different States ; note their boundaries, observing to what extent they are natural, the extent of railway development and the positions of the chief towns and ports.

Note the positions of the following trans-isthmian railway and canal routes :

Puerto Barrios (Santo Tomas) to San José connecting Guatemala with each coast.

Puerto Limon to Punta Arénas connecting San José with each coast.

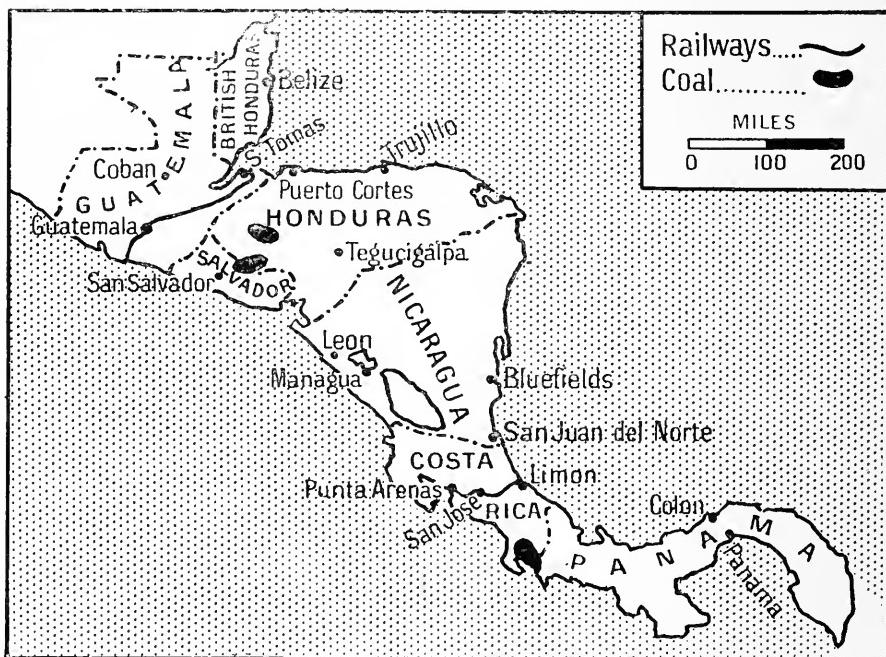


Fig. 75.—CENTRAL AMERICAN STATES.

Puerto Cortez to Amapula.

Colon to Panama Canal (fig. 76).

Puerto Mexico to Salina Cruz. } Fig. 71.
Tampico to Manzanillo.

Which of these are in Mexico ? In which States are the others situated ?

British Honduras contains but little cultivated land and is poor in minerals, its inhabitants being chiefly engaged

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in lumbering for cabinet and dye woods, and in obtaining forest products, e.g. rubber, sarsaparilla, palm oil.

Note the position of Belize the chief town and port.

Honduras. This country is at present but little developed though it probably has very varied mineral wealth which is as yet comparatively little worked. The chief export is bananas, sent mostly to the United States.

To which ports of the States will these be sent ?

Which is nearest ?

Note the position of Tegucigalpa the capital—also of Jutigalpa and Comayagua (a cattle centre) and of the seaports Amapula, Truxillo, and Puerto Cortez.

Which of these have railway connections ?

Guatemala has on the whole the best climate of the Central American States. A careful study of its topography will explain why this is so. The country falls into five divisions very much like those of Mexico. There is the usual marshy and malarial coast. As throughout these States the Atlantic coast is the more malarial, it will be readily seen that the unhealthy region is much reduced by the short eastern coastline.

Secondly, we find behind the coastal plain a precipitous mountain line with volcanic peaks towering up above it. The bulk of the remainder of the country behind this line is a vast plateau known as the Altos or Highlands, with a very pleasant climate. To the north, the plateau gives way to a succession of terraces, while the Plain of Peten, which is a geographical continuation of Yucatan, affords fertile grazing land.

The products are much the same as those of the neighbouring States, including especially coffee (on the mountain slopes), cacao, native rubber, bananas, and medicinal plants.

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Gold and silver are mined and a great variety of minerals, including coal, is to be found throughout the country, but it is not at present known if they are in sufficient quantities to be worth mining.

Note the positions of the following chief towns: New Guatemala, the capital, Quezaltenango, Totonicapam, Coban, La Libertad.

What means of communication have they with one another and with the chief ports, namely Champerico, San José, Livingston, and Barrios (Santo Tomas).

Recall the practice of growing coffee on the hillside; note especially the position of Retallhuleu, the chief coffee centre. How is the coffee exported from there?

Costa Rica has in the past held the distinction of being the best governed of the Central American States and is therefore the most developed of them all. It has rich mines of gold, silver, and copper, which are comparatively well developed, and rich agricultural land, made fertile by a light volcanic soil. Some 6,000,000 bananas are exported yearly to the United States and its coffee is famous all over the world.

Note the positions of San José, the capital, and of the ports Punta Areñas and Limon. Observe the trans-isthmian railway.

San Salvador, though the smallest, is the most densely populated State.

Observe the coast on which it lies; note the plateau-like nature of most of the country and thus connect the density of its population with the healthy character of its climate.

Gold and silver are mined and coffee is the chief of its products, which are similar to those of the other States of Central America.

San Salvador, like Guatemala and indeed most of the capitals of Central America, has had to be moved from its original site because of the prevalence of earthquakes.

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Note its position and those of Santa Aua and San Miguel and of the ports Libertad, Acajutla, and La Union. What railway connections are there?

Nicaragua is the largest of these States. It is probably the most richly endowed, though at present its wealth is not exploited.

Note the varied character of its surface and contour. On which coast are the mosquito swamps situated?

As in Guatemala, five distinct regions exist in the country, but they are very differently arranged. A series of

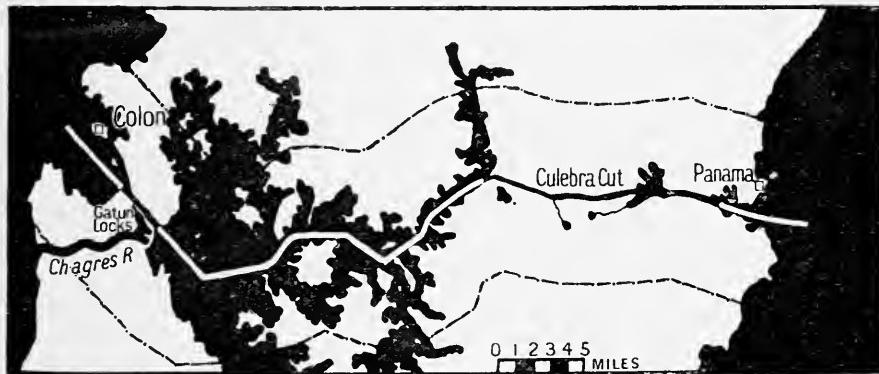


Fig. 76.—THE PANAMA CANAL.

The black area inland shows the portion of the country that has been flooded by the damming of the Chagres River at Gatun, and the white line indicates the ship's course. At Culebra a canal has been cut through the hill.

volcanic peaks run parallel to the Pacific coast. A central region of lakes and plain lies between these and the main Cordilleras, the backbone of Central and South America, in which there is here a complete break. The Cordilleras then fall in terraces to the mosquito coast. The country is liable to tornadoes, or cyclones, of a very violent character, to which the name Papagayos is given.

Note the position of Managua the capital, Leon Granada, and Masaya. The ports have good harbours, even on the east coast. Note their

positions—Graciás a Dios, Bluefields, the chief centre of gold mining, Greytown.

Suggest an explanation of the name Graciás a Dios (Thanks to God) connected with the generally insufficient harbourage of the Atlantic coast of Central America.

The natural products are as in the other States. Note that rubber is now being cultivated here.

Panama is the last of the Central American States to



Fig. 77.—VIEW OF CULEBRA CUT.

become independent. Its resources are as yet comparatively undeveloped, but the country has become of world-wide interest because of the action of the United States Government in purchasing a ten-mile strip across the country to complete the ship canal originally commenced by the French engineer, Ferdinand de Lesseps.

What wonderful ship canal between Asia and Africa was constructed by this engineer?

Note the positions of Colon and Panama, the Atlantic and Pacific termini respectively of the Panama canal. Though the Atlantic

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and Pacific are respectively eastern and western oceans, what is the general direction of this canal which is to connect east and west?

EXERCISES AND QUESTIONS

- (1) Compare the States of Central America as regards area and population. For these comparatively small States the larger scale is desirable. To avoid confusion, the scale must be clearly marked below each diagram.

Scale: 1 sq. mm. = 100 sq. miles.

1 sq. mm. shaded = 50,000 people. See Table I.

- (2) Compare these States as to the value of their (a) total trade, (b) imports, (c) exports, and (d) trade (total) per head of population. What is the chief import and export in each case? Consider the climate and explain why cottons form so generally the chief articles of import. Can you explain why the chief articles of import in Belize should be the same as the chief articles of export? Which country has the greater part of the import and export trade respectively with each of these countries? (Tables II and III.)
- (3) How do Guatemala and Honduras compare with one another in the production of cereals? How does the former compare with the United Kingdom in the total number of bushels of cereals produced relative to the total area of the country? (Table IVa.)
- (4) Compare Guatemala, Nicaragua, and Honduras as regards other agricultural products. Which is the most productive of these three countries? (Table IVb.)
- (5) Compare the Central American States as regards live stock. Which has the greatest number of cattle? (Table V.)
- (6) How do these States compare as to railway development? Which has the greatest length of line (a) absolutely? (b) relative to its area?
- (7) Note from your atlas the position of *some* of the following volcanoes. How do they lie relatively to one another?
In Nicaragua: Coseguina, Viejo, Monotombo, Omelepe, Madera.
In Costa Rica: Irazu, Turrialba, both over 11,000 ft., Chinqui.
In Salvador: Santa Aua, Quizate, Peque, San Miguel, Conchagua, Conchaguita, Izalco.
In Guatemala: Tajamulco, Tacana, Acatenano, Fuego, Pacaja.

CHAPTER IX

THE WEST INDIES

Study carefully a map of the West Indies. How do they lie? Which islands lie toward Florida, Central America, and South America respectively? Name the various groups. Which are the largest islands? Which are the chief British possessions? Name the two large republics and the chief islands and groups belonging respectively to France, Holland, and the United States.

A COMPARISON of fig. 9 with the atlas indicates at once the fact that the West Indian Islands consist of the summits of a chain of mountains extending in a vast curve from South America to Central and North America. In geological history and resulting structure these islands fall into four groups, three of which form roughly parallel zones; firstly, an interior volcanic zone, found only in the Lesser Antilles; secondly, a zone consisting mostly of Cretaceous and early Tertiary rocks, and comprising most of the Greater Antilles and the outer margin of the Lesser Antilles; thirdly, a low-lying zone consisting of later Tertiary and Quaternary deposits, and like the second zone broader at its western end. The fourth group, including Trinidad and the islands off the north coast of South America seems to have shared a different geological history, probably that of the mainland. The Peninsulas of Florida and Yucatan both seem to belong to the same geological period as the second zone.

What would you conclude from these facts as to the frequency of upheaval of these islands? How would you connect these formations with that of the accompanying inland sea? What great upheaval corresponds with the European Mediterranean?

How did the volcanic regions there lie relatively to the upheaval and the inland sea? What reason do you suggest for their being on the inner edge in each case?

In spite of this varied geological history, mineral wealth is not abundant, though many metals and some coal of poor quality are worked. Perhaps the most



Fig. 78.—THE BANANA HARVEST.
(From Stereograph Copyright, Underwood & Underwood, London.)

remarkable mineral product is the asphalt which is derived from the lakes of pitch in Trinidad.

Something like a sixth part of the islands lies at an elevation of over 1500 ft., though, as we have already discovered, a large number of them are low and comparatively level.

What do you conclude as to the climate of the islands as a whole as compared with the mainland and as compared with one another?

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Look at the isotherm map (fig. 17) and determine between which isotherms the islands lie. What difference in these isotherms will be caused by the altitude of the loftier islands?

For reasons which we have already explained, the seasons are alternate wet and dry ones. In the case, however, of islands near the equator there are two wet and two dry seasons each year.

Can you explain this from what you have already learned as regards monsoon winds? How often in each year is the sun vertical over any one of these islands? Can you explain from this why May and October are the wet seasons? Where is the barometric minimum when the sun is vertical over any sea-girt land? In which of these months, May or October, has the sun been longer

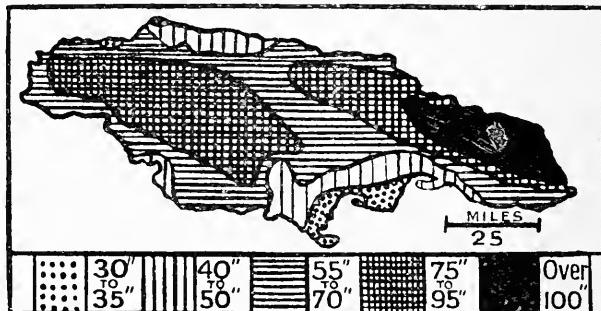


Fig. 79.—JAMAICA RAINFALL.

Compare with a map showing elevations, and explain the distribution of the rainfall.

over the Northern hemisphere? In which of these wet seasons will, therefore, by far the stronger minimum be produced? Can you account for the October season being the wettest of the year and also for the violent hurricanes to which this season is subject?

A considerable difference in rainfall exists between the different coasts of the loftier islands.

What is the prevailing direction of the ocean winds in these latitudes?

Why have the south and west less rainfall than the north and east? e.g. the north-east coast of Jamaica has a rainfall of over 100 inches, while Kingston has a fall of less than 40 inches (see fig. 79).

With such wide variations both in soil and climatic conditions, it is small wonder that the products of these

islands are so rich and varied. Sugar, fruits of all kinds (*e.g.* limes, bananas, and pine apples), cacao and spices are some of the most important exports and many of the names have become familiar to us in connection with some industry connected with its produce, *e.g.* Jamaica rum, Montserrat lime juice, Havana tobacco and cigars.

Note and comment on the positions of the chief ports and capitals



Fig. 80.—ST PIERRE AFTER THE ERUPTION OF MT. PELEÉ.

(From Stereograph Copyright, Underwood & Underwood, London.)

of some of the more important islands: Port of Spain, Trinidad; Port au Prince, Haiti; Kingston, Jamaica; Havana, Cuba.

On which sides of the islands do they lie (a) relatively to the prevailing winds? (b) relatively to the mainland?

Note the following islands. Compare their relative development. *Cuba*, called the Pearl of the Antilles.

Chief products—tobacco, sugar, coffee, and tropical fruits. Great development of iron mining during the last few years.

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Recall the result of the war between Spain and U.S.A. and account for the industrial development of this island.

Cuba has some 1000 miles of railway. How does it compare with the length of the island?

Note the position of the capital and chief port, Havana.

Jamaica—a British Crown colony—is noted for the quality of its coffee, called, from its source, Blue Mountain coffee. Whilst Cuba and Barbados are almost the only islands that now make sugar-growing for export profitable, the sugar grown in Jamaica is almost all converted into rum.

It has 200 miles of railway. How does this compare with its length and with Cuba? Note the position of Kingston, the capital.

Note the island of *Haiti* or *Hispaniola* divided between the comparatively backward republics of Haiti and Santo Domingo.

Porto Rico, another Spanish island which was ceded to the United

Note the British possessions in the lesser Antilles and also the French islands of Guadeloupe and Martinique, the capital (St Pierre) of which was destroyed in 1902 by the eruption of Mont Pelée.

States in 1898. Chief products:—Coffee, sugar (encouraged by the United States), and tropical fruits.

Tropical fruits, coffee, cocoa, and sugar are the chief products of all the islands.

Barbados has a splendid climate and soil, and is almost entirely given up to sugar cultivation.

Note the position of Port of Spain, the capital of Trinidad.

The Bahamas are all British, and mostly uninhabited. Pearl and sponge fishing are characteristic occupations of the people of the few inhabited islands.

PRACTICAL EXERCISES AND QUESTIONS

(1) Compare the area and density of the West Indies with those of the Central American States. Draw a diagram to the same scale (see Chap. VIII, question 1). (Table I.)

What climatic consideration would suggest an explanation of the greater density of these islands?

Recall the early colonial history of these islands and the history of the slave trade and suggest some possible connection between their history and the density of their population.

(2) Trace a map of the West Indies naming the chief British possessions among them. Which of the other islands are republics? Which are colonies of other European nations? Which large island is administered by the United States?

(3) Discuss the effect of the opening of the Panama Canal upon the chief of the West Indies.

CHAPTER X

OUTLINE OF THE HISTORY OF NORTH AMERICA

THE origin of the native races of America is a question that will probably never be satisfactorily settled, for though certain of them reached a high degree of civilization, yet they left no written records as to their previous history, and as they were for so many centuries isolated from the Old World, any similarities which may have existed have almost died out. Some investigators, however, have discovered resemblances to the Mongolian races of the Old World, which they consider sufficiently striking to support the theory that the natives of America reached that continent from the east of Asia, either by crossing the Behring Straits, or more probably by crossing the land which in far remote times joined the two continents. The existence of such a bridge is borne out by the evidences of subsidence on the east coast of Asia, while the close relationship of all the tribes, both of North and South America supports the theory of a common ancestry.

The gradual spread of these wanderers southward and eastward throughout the continent must have been a long and gradual process and their progress in civilization varied greatly with the kind of country they found. Those who reached the great plains and forests became nomad tribes of hunters. The settlers in the tropics were and are on the whole the least progressive, while the highest civilization was reached in what would seem the least favourable

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localities, namely, the dry, bleak tablelands of Mexico and Peru, where the Spaniards on their arrival in the fifteenth century found the great empire of the Aztecs and the Incas respectively. This is but another illustration of the truth borne out by history that mankind progresses only in the face of a certain degree of opposition and difficulty.

But, interesting as is the early history of America, the

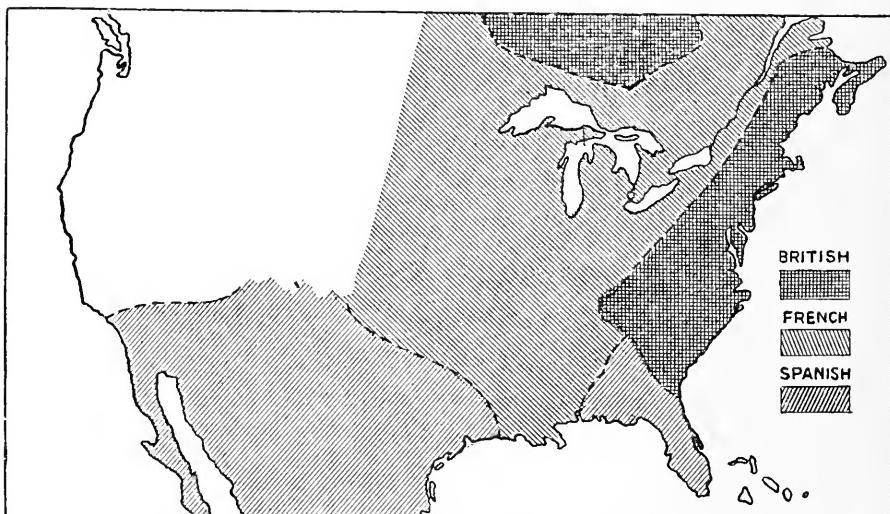


Fig. 80A.—NORTH AMERICA IN 1740.

native question has remarkably little importance when considering modern conditions. The coming of the white man to North America changed the whole history and conditions of life to an extent unequalled in any other part of the world, except Australia. Three nations are especially concerned with the history of North America, and have left traces of their connection with it to a greater or less extent—namely, Spain, France, and England.

The Spanish—as first arrivals in 1492—claimed the whole continent, but were unable to hold it. They chose,

however, what seemed to them the best and richest parts, that is, Mexico, Florida, and the Isthmus, and planted settlements there. (See fig. 80A.)

The French explored the St Lawrence and founded Canada—travelling across the great lakes they worked their way southward and discovered the Mississippi. New Orleans, which still bears marks of its origin, and the district of Louisiana were founded at the mouth

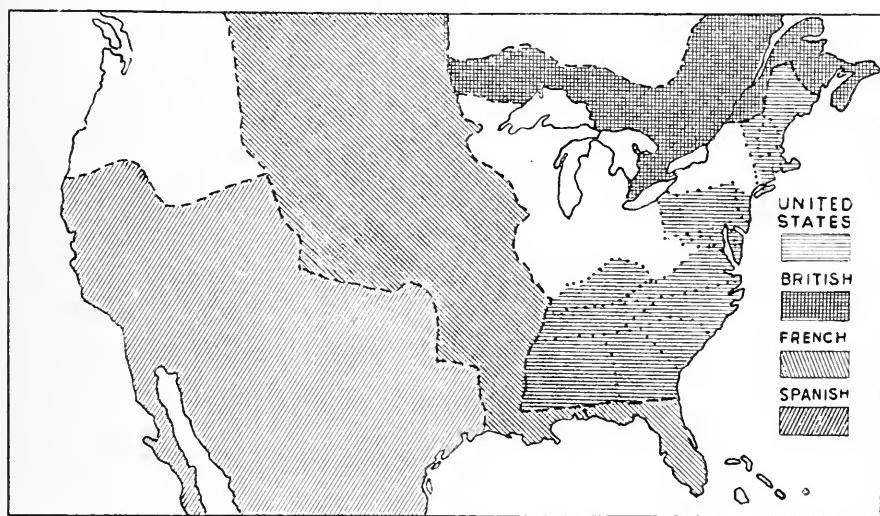


Fig. 80B.—NORTH AMERICA IN 1801.

of this river and the French dreamed of a great empire uniting this district with Canada. (See fig. 80B.)

The English formed numerous settlements on the coast between Florida and Canada, but were content for a long time to allow the Alleghanies to form their westward boundary. The Hudson valley was the only easy means of communication to the northward and many a stirring incident is connected with this highway between New England and New France. Nova Scotia (formerly La Cadie or L'Acadie) was long a bone of contention between

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England and France, but the former succeeded in making good their claim to it, though the French settlers held out sturdily against them.

The methods of the three nations form an interesting and instructive contrast. Broadly speaking, we may say that the Spaniards sought for wealth, the French for empire, and the English for trade. Spain ruled her colonies by the power of the sword, the French strove to establish

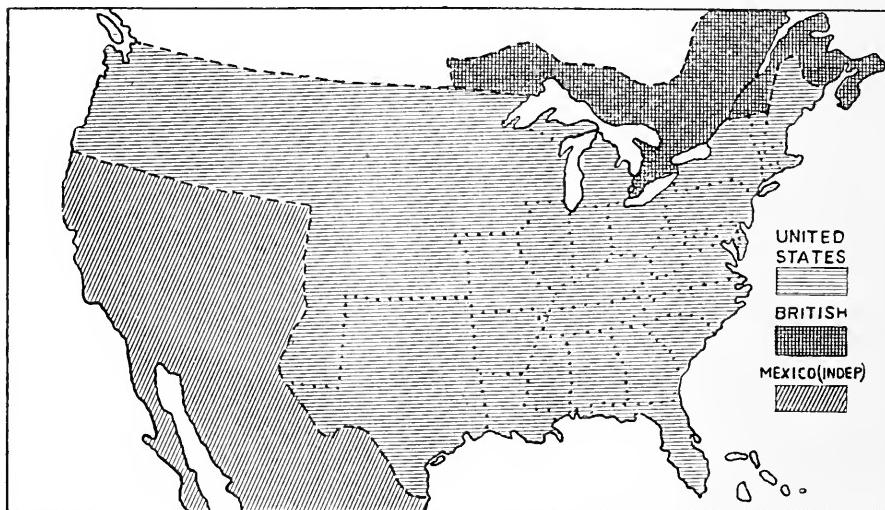


Fig. 80c.—NORTH AMERICA IN 1845.

diplomatic relations with the various chiefs, the English unconsciously built up far firmer relations by their trade, until they had become so strong as to be independent of the natives. The history of North America in the eighteenth century is filled with the struggle between France and England for the possession (1) of the Ohio basin, the most accessible region west of the Appalachians, (2) of the Hudson River valley, and (3) of Maine, Nova Scotia, and Cape Breton Island.

In all these struggles the English were finally successful,

but their success was marred by the revolt of the American Colonies in 1776, followed by their resulting separation and the formation of the United States of America. These States have spread steadily westward adding State after State to the original thirteen. By 1819 all the lands south of the great lakes and east of the Mississippi were included in their republic. Louisiana, previously ceded by the French to the Spanish, was bought from the latter in 1803 and Florida in 1819.

In 1821 Mexico became a republic, and its defeat in the war of 1845 with the United States led to the addition of Texas, Iowa, and California to the States. The purchase of Alaska from Russia in 1867 was led up to by the attempt to establish telegraphic communication with Europe by that route, though the successful Atlantic cable rendered it unnecessary. (See fig. 80c, page 156.)

Both Atlantic and Pacific coasts were thus in their hands and it was only a question of time and an extension of the means of accesses for the inclusion of the enormous intermediate district, which was gradually being colonized by the enormous influx of emigrants both from Europe and from the more settled eastern States. This was accomplished about 1854, and strangely enough this union very nearly led to disunion. The differences between the Northern and Southern States were chiefly due to geographical causes. Thus the Northern States were mainly industrial and desired protection from the more developed industries of England, the Southern were producers of raw material and averse to taxes on the manufactured articles which they were bound to import. The Southern States thought it impossible to dispense with slave labour, for which the Northern States had no use, and eventually matters actually had to be decided by the

Civil War of 1861, in which the Northern States were successful. Since that event the advance of the States has been more rapid than any recorded by history, though British North America is following closely at its heels. In both cases the rapidity of advance has been almost entirely due to the fact that the nineteenth century provided them with a means of communication far superior to any previous one, namely, railways, and a glance at the railway maps will show how progress has followed the railway line—for many of these lines were built before the settlements, which they now link together, had even been founded.

In closing this short summary, attention may be drawn to the remarkable boundary between Canada and the Western States—the longest of its kind and yet one of the most perfect, for it has never been violated by a hostile army from either side. By treaties in 1818 and 1846 it was agreed that lat. 49° N. should be the boundary between them from near Lake Superior to the Pacific, and the success with which the agreement has been kept argues well for the advantage of such a mathematical boundary, which may well be contrasted with the innumerable disputed boundaries of other parts of the world.

Compare carefully the accompanying maps and endeavour to discover to what extent any of the following geographical considerations have affected the rate of the development of the different parts of North America.

- (1) Accessibility relative to other parts of the world. (East and west coasts.)
- (2) Character of the hinterland of any river settlement or of any strip of coast.
- (3) Character and extent of the mountain ranges.
- (4) Size, character, and situation of navigable rivers.
- (5) Climate.
- (6) Produce of the soil.
- (7) Minerals.

REVISION QUESTIONS ON NORTH AND CENTRAL AMERICA

By kind permission of the University of Cambridge Local Examinations Syndicate the following questions have been taken from *Senior* examination papers and can be well answered by students who have worked *conscientiously* through the preceding chapters.

- (1) Describe the route of the Canadian Pacific Railway, giving an account of the character and industries of the districts through which it passes.

Construct from the industrial and railway maps a special map to illustrate your answer to this question.

- (2) Describe and explain the origin of (a) the Colorado Cañon, (b) the Chinook winds, (c) the Niagara Falls.

- (3) Give a brief description of Jamaica.

- (4) Give some account of the districts in North America (a) where wheat is grown, (b) where gold is found.

- (5) Contrast and account for the climates of the East and West coasts of Canada.

- (6) Describe the Cordilleran or Pacific mountain system of North America and also the general character of the rivers of the Pacific slope. Why is the Pacific coast north of the Columbia River so different in character from the coast to the south of it?

In answering the latter part of this question, consider areas of elevation, areas of depression, structure and climate.

- (7) Give an account of the mineral resources of the St Lawrence basin. Mention the most important manufacturing industries, districts, and towns in this territory. Illustrate your answer by a sketch map.

- (8) Why is "The United States" more vitally interested than any other nation in the Panama Canal? What countries and seaports to the north of the Canal are most likely to be affected by the opening of it?

- (9) State carefully the position of the following towns and explain how far each owes its importance to its position. New York, Montreal, Toronto, St Louis, Mexico City, Halifax, Havana, New Orleans, Philadelphia, Vera Cruz.

- (10) Describe and account for the characteristics of (a) the Tundra region of North America, (b) the Western Temperate region, (c) the Great Basin.
- (11) In which parts of North America are (a) cotton, (b) maize, (c) sugar-cane, extensively grown? Give an account of the conditions which favour the production of each.
- (12) Describe the physical character of the coastal region of the United States between Florida and the Bay of Fundy and show how it has influenced the progress of colonisation and subsequent development of the country.
- (13) Explain the following terms, illustrating them by examples from North America: drowned valley, Mediterranean climate, rain-shadow.

CHAPTER XI

SOUTH AMERICA: STRUCTURE

Make a careful map study of the South American Continent. What is its shape? What are its extreme north and south latitudes respectively? What are its extreme east and west longitudes? How does it compare with North America in all these respects? In what latitude and climatic zone does it lie at its greatest breadth? Measure the breadth and compare it with that of North America and of the old world. What advantages or disadvantages result from this tropical situation? What is the extreme range of time in South America? What is the time at Pernambuco and Guayaquil respectively when it is mid-day at Greenwich? Name the chief mountain ranges. How do they lie relatively to the coasts and to the mainland? Which are the most extensive regions of plains? Are they low-lying and alluvial, or lofty and plateau-like? On which side of the continent are the loftiest plateaux to be found? Name the three chief river-basins forming the vast low-lying plains.

WE thus observe that the structure of South America presents a strong similarity to that of the northern portion of the continent, falling, as it does, into three distinct regions.

What were the three regions of North America? Name the corresponding regions of South America. Which mountains correspond to the Rockies? To which region of North America do the highlands of Brazil correspond? Compare the direction of flow and relation to one another of the St Lawrence and the Mississippi on the one hand and the Amazon and the Plate River on the other.

What have we noted as to the character of the divide between the basins of the St Lawrence and the Mississippi River? Name the three rivers corresponding to the three plains of South America and note the character of their divides. By what river are the

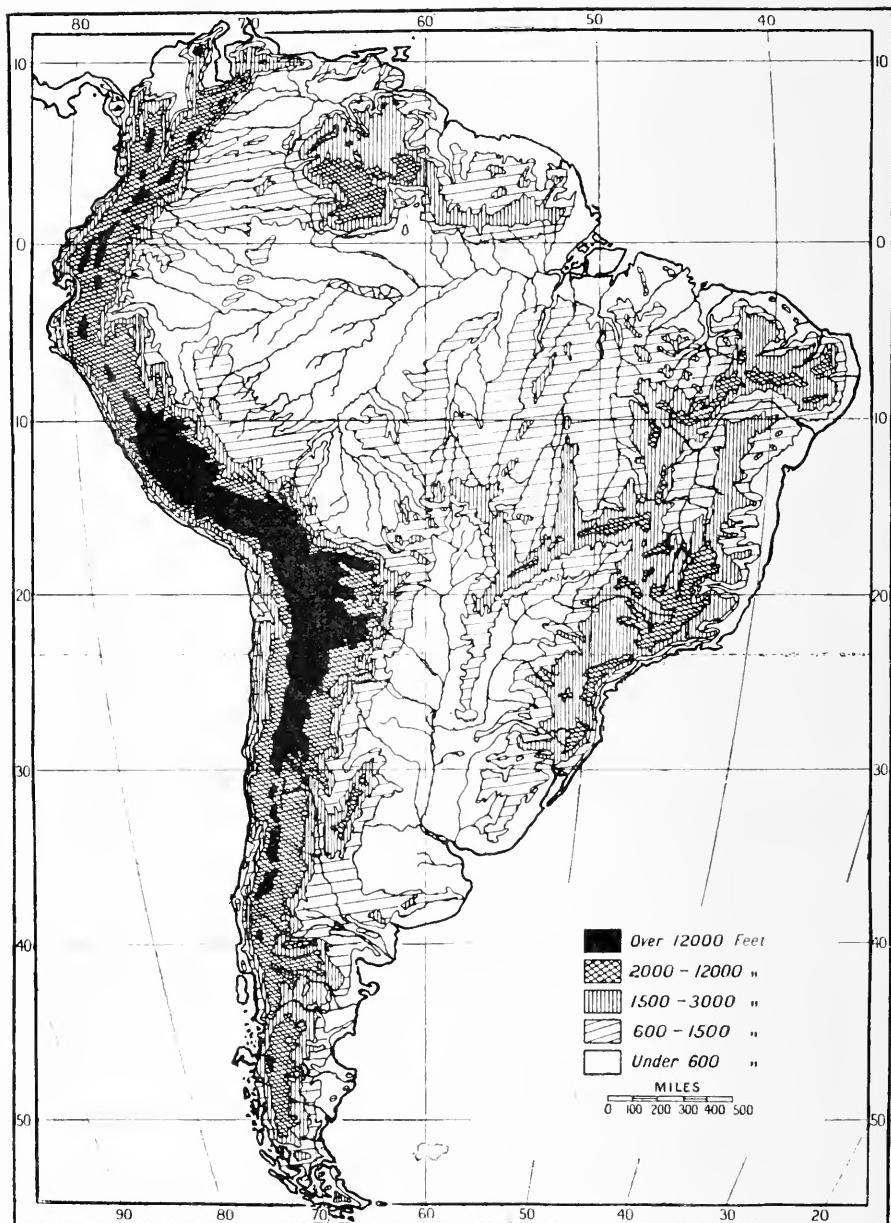


Fig. 81.—SOUTH AMERICA; CONTOURS.

basins of the Orinoco and Amazon actually connected ? How may this be regarded as a stage in the process of river piracy ? What considerations will finally determine into which river basin the waters in this branch will eventually flow ?

This resemblance in the structure of North and South America is still further marked by the geological history of the two continental masses.

Which are the oldest mountains of North America ?

So also in South America the eastern mountain regions, lying between the mouths of the three chief river basins, are all ancient and much faulted and denuded block mountains.

Compare the positions of the Brazilian tableland and the mountains of Guiana with those of the Appalachians and the Laurentian plateau respectively.

On the other hand, the Andes, though much loftier than the Rockies, have many points in common with them.

Consider this statement with reference to

(a) situation, (b) general trend, (c) volcanic activity, (d) nearness to the coast, (e) relative steepness of eastern and western slopes respectively. (See figs. 81, 82, 9, and 10.)

A glance at the contour map will show that the greater part of the South American continent rises steeply from the ocean. Thus on most of the west coast there is no continental shelf, and as the 10,000 ft. contour line beneath the ocean lies comparatively close to land, there is no good harbour north of Valparaiso.

What length of coast is thus practically harbourless ?

How does this agree with the statement that the rising from the sea of the greater portion of the South American continent accounts for the absence of really good roadsteads and harbours ? To answer this question, explain the process by which a coast line becomes indented.

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It is only in the southern and comparatively narrow prolongation of the continent that a much indented fjord-like coast is found, which gives way finally to a number of precipitous rocky islands.

Discuss the formation of these fjords and their relation to the great

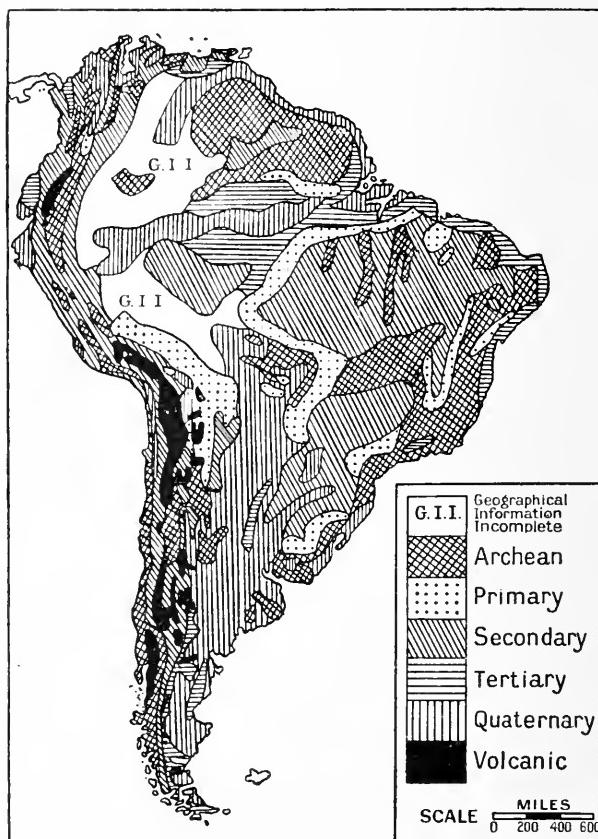


Fig. 82.—ROUGH GEOLOGICAL MAP OF SOUTH AMERICA.

Compare with fig. 81 and thus determine the relative ages of the Rocky Mountains and the highlands of Guiana and Brazil.

Andean chain. Also connect these physiographical conditions with the statement that South America was at one time connected

with Australia through the Polar regions. What would be the effect on the southern coasts of such a subsidence as would permanently disconnect the Antarctic continent from South America ?

Nor is the east coast much better provided with harbourage. Apart from the river mouths, Rio de Janeiro is the only really good natural harbour on this coast.

Connect the formation of this harbour with the character of the immediate hinterland. Do you know of any other port in the world, the harbour of which is almost landlocked and has been formed by subsidence ?

Apart from this comparatively short stretch of coast where the Sierra do Mar reaches the sea, we find no further instances of subsidence and the bulk of the remainder of the east coast is low, swampy, and harbourless.

How would you connect this with the size and character of the rivers flowing eastward ? On which coast must the greater part of the river silt of South America be deposited ?

Study carefully the distribution of the lowlands of South America. To which three river basins respectively do they correspond ?

The sheep-grazing plains of the Orinoco basin are called *llanos*, the densely wooded plains of the Amazon *selvas* (Latin, *silva* = a wood), and the grassy plains of the rivers forming the Plate River, *pampas*.

The vast cordilleran belt of the Andes contains some of the highest mountains, plateaux and valleys, and also the highest lake in the world.

Observe on the map in your atlas the position of Lake Titicaca. Compare with fig. 81 and determine roughly its height above sea-level.

Estimate the extreme length of the Andean chain of mountains and also the position and extent of its maximum breadth. Observe how at its northern extremity it divides and turns eastward. What coastal and river formations are due to this trend ? Note that the island of Trinidad is a seaward prolongation of the range.

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What river basin lies between them and the ancient block mountains of Guiana?

If the Andes are to be considered at all as a southern prolongation of the Rockies, it is round the sweep of the



Fig. 83.—SOUTH AMERICA : MINERALS.

In the cases of coal and petroleum compare with fig. 82 and

in the case of the nitrates with figs. 89, 90, and 91.

Compare with fig. 85 and show which regions are supplied with good facilities for transport.

West Indian islands and along this eastern bend that the folding probably took place.

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To the punas or lofty plateaux of the Andes we shall refer again in studying the western countries in detail, as



Fig. 84.—SOUTH AMERICA : MINERALS.

Compare with fig. 85 and show which regions are well supplied with facilities for transport. Which minerals are least dependent upon railway development as regards their mining and production?

also to the character of the narrow coastal plain to the west of the Andes.

With such a varied structure as this continent has, with a vast cordilleran chain of mountains forming up-

folds of rocks of, geologically speaking, recent formation, with two groups of eastern block mountains, covered with rocks of the Secondary Age, and with a long chain of volcanoes, many active to the present day, it is not to be wondered at that South America should be possessed of rich mineral wealth of all kinds.

As we shall see when studying the countries in detail, coal of varying qualities is fairly widely distributed and to a less extent petroleum; in neither case, however, is the fuel greatly worked, often scarcely enough to provide the quantities required for home consumption.

Look at the rough geological map and account for this wide distribution of coal. What is, roughly speaking, the geological age of the different kinds of coal? (Figs. 82 and 83.)

PRACTICAL EXERCISES AND QUESTIONS

- (1) From fig. 81, construct an elevation (a) along lat. 0° , (b) along lat. 20° S., and assuming that the scale of the map is about 400 miles per cm., determine approximately the exaggeration of the vertical scale you use—say 1 cm.=1000 ft.
- (2) Study carefully a physical map of South America and find the positions of the chief peaks, as follows:

	Approximate Height.		Approximate Height.
Andes :		Brazil :	
Aconcagua . . .	23,000 ft.	Itahaya . . .	9820 ft.
Mercedario . . .	22,300 ,,		
Sorata . . .	21,500 ,,	Guiana Highlands :	
Ilimani . . .	21,000 ,,	Roraima. . .	8740 ft.
Chimborazo . . .	20,500 ,,		
Juncal . . .	20,200 ,,		
Cotopaxi . . .	19,600 ,,		

- (3) Make a careful map of the three chief river basins of South America, naming the chief head rivers supplying the Amazon and Plate River respectively.
- (4) Construct from the contour map a rough regimen of the Amazon and of the São Francisco respectively.

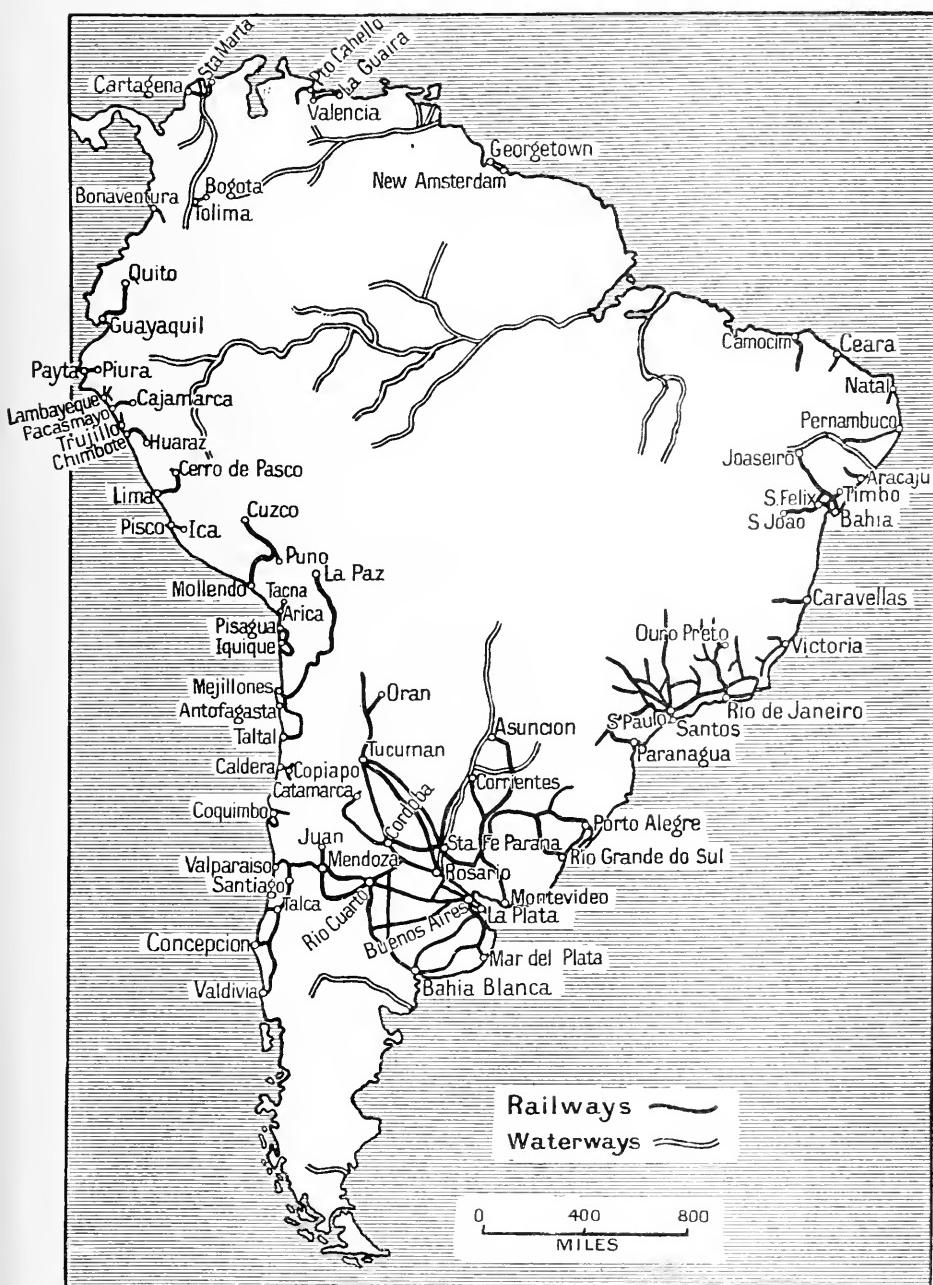


Fig. 85.—SOUTH AMERICA: MEANS OF TRANSPORT.

CHAPTER XII

SOUTH AMERICA : CLIMATE

IN the case of a continent which extends from tropical latitudes north of the equator to temperate regions south of the equator, it is impossible to deal adequately with the climate as a whole. Nevertheless, there are certain clearly marked features which well illustrate the application of the general principles which we have already studied.

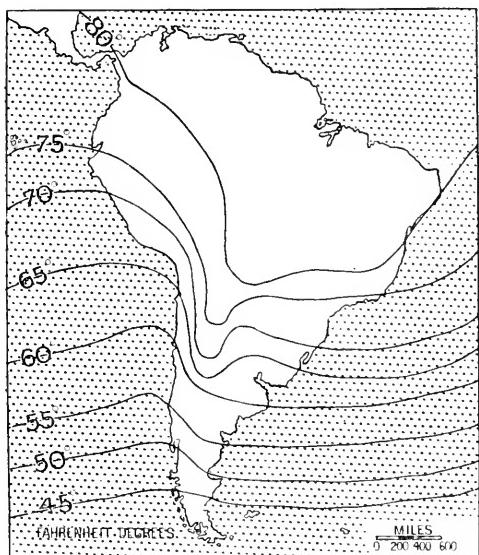


Fig. 86.—ANNUAL ISOTHERMS.
(SEA-LEVEL.)

A glance at the figs. 86–88 (isotherm maps) will show to what extent changes of latitude affect the climate of South America.

What are the average summer and winter temperatures of Southern Argentine? Compare them with those of Ecuador. In which

Shortly revise the various factors affecting climate. What is the influence of
(a) latitude? (b) the sea?
(c) the direction of the prevailing wind?
(d) position on the east or west coast?
(e) situation relative to mountains?
(f) altitude?

region of the continent do the isotherms most consistently follow the lines of latitude? In which season of the year do they least coincide with them?

Before discussing the reason for this apparent discrepancy in the map of December isotherms, it is desirable to consider the influence of the sea and prevailing winds upon the general distribution of climate over the continent.

In which latitude are the greatest distances from the sea to be found? In which the least? What is the range from summer to winter temperatures in each of these regions?

Thus we do not find in South America the marked differences between continental and oceanic climate that we should have expected from our experience of Europe. A glance at the map will show that it is only in the temperate regions that the isotherms turn northward during one half of the year and southward during the other.

What is the meaning of an isotherm turning northward in the southern hemisphere? and of one turning southward? How do the isotherms tend during each half year over tropical South America?

What do you conclude as to the moderating influence of the sea upon climate in tropical regions as compared with its influence in temperate zones?

The fact that the sea has more of a moderating influence

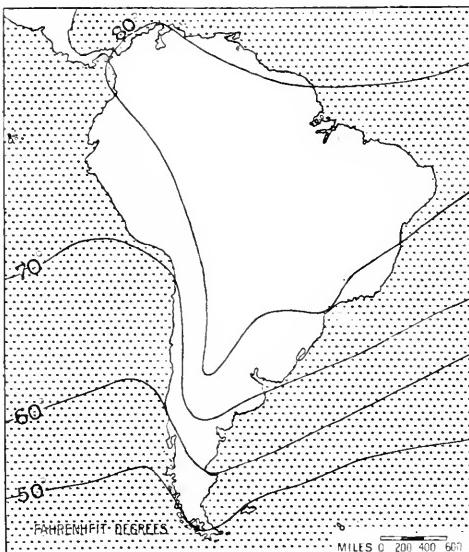


Fig. 87.—DECEMBER ISOTHERMS.
(SUMMER IN S. TEMPERATE ZONE.)

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in warming than in cooling has already been indicated in the climate of our own islands, where we saw that the moderating influence of the sea was more marked in winter than in summer.¹ In the case of South America there are to be considered, however, several other causes of the peculiarities in the distribution of climate.

Look at the December isotherm map. What do you note about the character of the 80° isotherm? Compare the map with that of the winter rainfall. What do you observe? In what way do you connect heavy rainfall with high temperature and low barometric pressure? Over what tropic is the sun vertical in December? What must be the effect of the consequent intense heating of the large land mass of Brazil (a) upon the temperature of the land? (b) upon the atmospheric pressure over the same region?

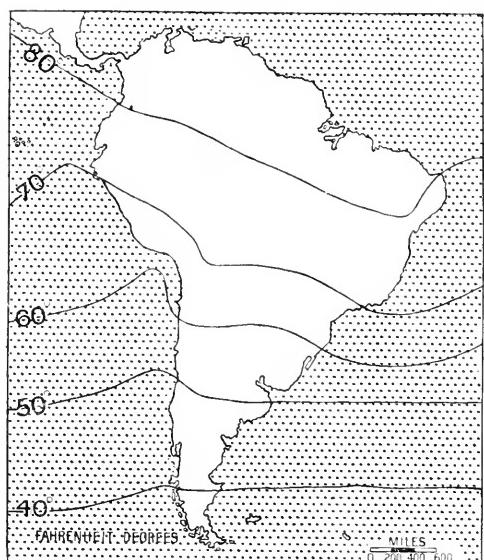


Fig. 88.—JUNE ISOTHERMS.
(WINTER IN S. TEMPERATE ZONE.)

We thus see that during one-half of the year a strong barometric minimum is established over central South America. A glance at fig. 4, page 18 will show the consequent indrawing of wind from the south Atlantic Ocean.

What will be the nature of this wind as regards moisture? Why is the wind not drawn in from the Pacific? What is the direction of the Pacific winds? Even if these winds were not already blowing away from the land, what would be the influence of the Andes?

¹ *Home of Man, British Isles*, page 108.

Where do we find barometric maxima established as a result of the minimum over the land? Look at fig. 4 and note the spiral movements thereby caused in the great oceanic wind belts.

It is to these great wind belts that we must therefore turn to explain the distribution of the varying climatic conditions in South America. The accompanying maps, figs. 86-91, if carefully studied and compared with the wind charts will supply all the necessary data far better than any verbal description. It is only necessary perhaps to emphasize in more general terms what we have already noted in one particular case, that the wet season of tropical monsoon countries is usually their summer—or perhaps, to express it better, as the term summer really applies only to a temperate climate

—the wet monsoon generally occurs when the sun is at its highest point in the heavens.

In studying the wind charts of the Atlantic and Pacific in figs. 3 and 4, it is interesting to recall what we have observed as to the extent of the movement during the year of the tropical belt of calms and the accompanying limits of the wind belts.

Through how many degrees does the vertical position of the sun move from its most northerly to its most southerly position?

We should, therefore, have expected the sun to have

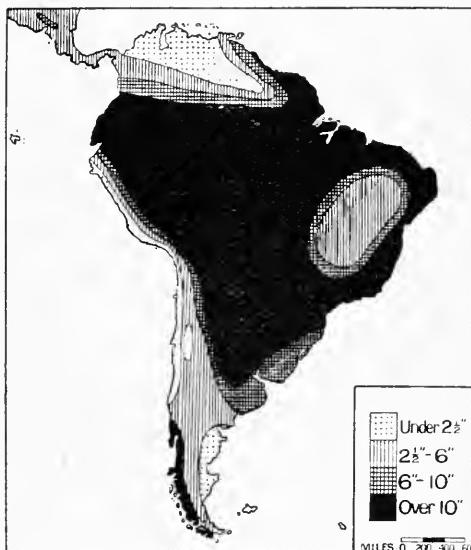


Fig. 89.—DECEMBER RAINFALL.

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carried with it the belt of calms along the latitude of maximum heating and therefore minimum pressure, but this is not by any means the case.

Look at figs. 3 and 4 and discover how many degrees difference there is between the January and July positions of the belt of calms in each ocean. Is it the same for each ocean?

Thus we observe that the equator of the world's temperature or equatorial isotherm does not, even across the

ocean, coincide with the geographical equator, but always lies to the north of it. In order to explain this fact, it is as well to recall what we have so often remarked, namely, that the moderating influence of the sea is most marked in the winter, while the extreme climatic influences of the land masses are equally shown both in summer and in winter, in hot as well as in cool climates.¹

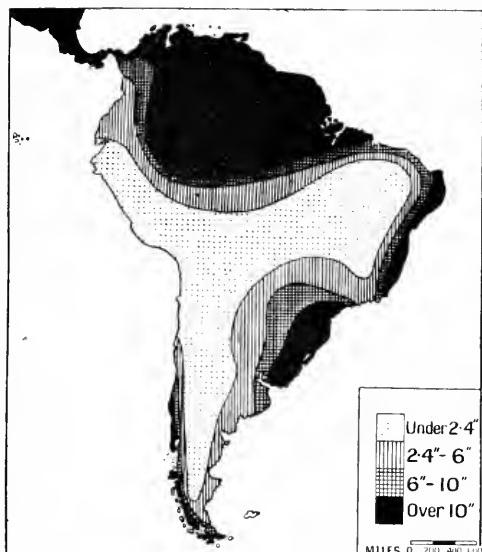


Fig. 90.—JUNE RAINFALL.

This fact of such great importance to the climate of South America, namely, that the belt of calms keeps further to the north in the Pacific than in the Atlantic, is probably also affected by another factor greatly influenc-

¹ It may be desirable to suggest as additional explanations of the comparative loss of the moderating influence of the seas in tropical climates (*a*) the large amount of energy they give up *at all times* to the land in winds heavily laden with moisture, and (*b*) the absence of a winter season, in which the sea can have time to cool.

ing the climate of the west of South America, namely, the presence of a cold current from the Antarctic up the west coast, the Peruvian current, also known from its discoverer as the Humboldt current. Having regard to the reversal of all water and wind movements in north and south latitudes respectively, the position of this current corresponds exactly to that of the Labrador current from the Arctic regions into the Atlantic.

Study carefully the two isotherm maps. What marked effect of this cold current is shown in the isotherms?

Having regard to the various climatic factors already considered, the position of the country, the variations of the seasons, the prevailing winds and the positions of the chief mountain chains and masses, you are now in a position, with the assistance of the accompanying maps, to give a fair account of the climate of any country of the continent.

Study figs. 86-91 carefully and answer the following questions :

Which is the hottest region of South America (a) in December ?
(b) in June ?

What effect has this distribution of heat on the distribution of rainfall ? Which is the wettest region ? How do you account for it ? Which are the driest regions ? What is the cause of these desert formations ? In each case discuss the prevailing wind and the lie of the mountains. Which region has the most evenly distributed rainfall ? Why is this even distribution of rainfall

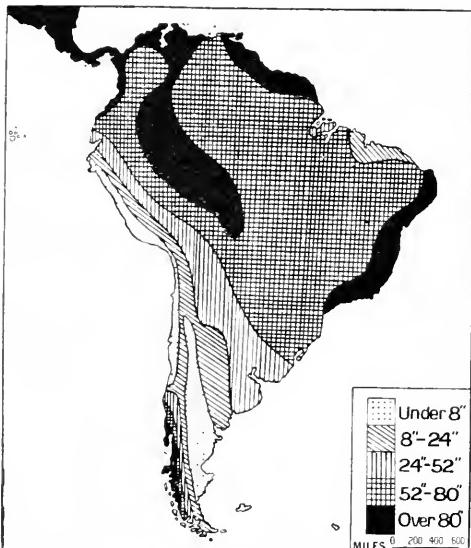


Fig. 91.—MEAN ANNUAL RAINFALL.

characteristic of the temperate regions? In answering this question, consider what conditions are necessary to establish at any given season a strong barometric minimum. Look at the rainfall maps and discuss how far south the monsoon region may be considered to extend.

Having carefully studied these climatic maps we are able to explain the distribution of desert, forest, and grassy lands throughout the continent; the vast tropical forest of the Amazon basin known as selvas; the broad expanse of grassy plain, the llanos of the Orinoco; the grassy pampas of the Argentine; the campos of Brazil, at one time luxuriant in grass, at another arid wastes; the caatangas or thorn scrubs of Brazil; the Matto Grosso (large woods); the Gran Chaco, the great hunting ground; the great desert of Atacama; the arid and stony Patagonian steppes on the east and the wooded fjords on the west of the southern extremity of the continent; and lastly the plateaux—the high, bleak Paramos of the northern Andes and the lofty valleys or punas enclosed between rocky fastnesses.

Classify these various regions into climatic groups:

- (a) those with a continuously moist climate (wooded);
- (b) those with rain at more or less regular intervals (grassy);
- (c) arid regions;
- (d) very cold regions.

Compare their climate with their situation relatively to the mountains and the prevailing winds (figs. 3 and 4, and 81), and show the dependence of the former in each case upon either or both of the latter.

PRACTICAL EXERCISES

- (1) On an outline map of South America mark the positions of each kind of plain indicated above. Shade in three different ways those regions which have respectively no rainfall, seasonal rainfall, and rainfall all the year round.
- (2) Study carefully the following table showing the average monthly

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temperature and rainfall of four different towns in South America and answer the questions appended. With advantage, curves may be drawn to compare the temperature and rainfall of each town.

Latitude . Height .	Bogota $4^{\circ}35' N.$ 8200 ft.		Rio de Janeiro $22^{\circ}54' S.$ 185 ft.		Buenos Ayres $34^{\circ}37' S.$ 72 ft.		Puerto Montt $41^{\circ}30' S.$ 33 ft.	
	Av. Temp. °F.	Av. Rain- fall inches	Av. Temp. °F.	Av. Rain- fall inches	Av. Temp. °F.	Av. Rain- fall inches	Av. Temp. °F.	Av. Rain- fall inches
January .	57.5	3.7	77.5	4.8	73.6	3.0	58.4	5
February	58	3.5	78	4.4	73	2.5	58.2	4.3
March .	58.4	4.5	77.2	5.1	69.6	5.0	55.4	7.1
April .	58.5	9.6	74	4.6	62	3.0	57.4	7.3
May . .	58.4	6.5	71	3.6	56	2.8	48	11.5
June . .	58.1	3.2	68	1.9	51	2.7	45.5	9.6
July . .	57.1	2.6	67.5	1.6	50	2.1	45	11.8
August .	57	3.3	68.5	1.9	52	2.4	45.5	9.5
September	57	2.9	69	2.3	56	3.0	47.5	6.6
October .	58	8.4	71	3.5	61	3.6	50.5	5.9
November	58.2	9.6	73	4.3	67	2.8	54	5.8
December	58.1	5.6	75	5.5	71.4	3.8	57	6.2
	Av. Annual Temp.	Total Rain- fall inches	Av. Temp. °F.	Total Rain- fall inches	Av. Temp. °F.	Total Rain- fall inches	Av. Temp. °F.	Total Rain- fall inches
	57.9	63.4	72.5	43.5	61.9	36.7	57.3	90.6

Which city is nearest the equator? Why is it not possessed of the warmest climate? Allow 1° F. fall for every 270 ft. rise and determine the sea-level temperature of Bogota. How would it then compare with Rio and Buenos Ayres? Which towns lie in the monsoon area and have seasonal rains at the hot season? Which lies in temperate regions and has winter rains? Which town has a heavy autumn rainfall? Account for this by considering the region over which the sun is vertical in March and where the chief region of barometric low pressure is being produced. Observe a similar increased rainfall in Rio in September when the sun is once more returning to its vertical position over

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the Amazon basin. Recall that in the autumn (March) the sun has for six months been vertical over South America and therefore is then exerting its very greatest heating power in the Amazon basin and then explain why the September rainfall is less than that in March.

CHAPTER XIII

SOUTH AMERICAN STATES: COLOMBIA

Study a large political map of South America and note the situation of Colombia. Between what degrees of latitude and longitude does it lie? What are its boundaries as marked on the map? Which oceans and which States are on its borders? Which of its boundaries are natural? Consider the comparatively unexplored and undeveloped character of some of the interior and explain the fact that some of its boundaries still have to be fixed. Where do three States join? Name the States. Which rivers flow wholly in Colombia? Into which ocean does the largest of them flow? Note the lie of the mountains and explain this. Find the position of the watershed between the San Juan and Atrato Rivers. Note the respective positions of the Eastern and Western Cordilleras, the Sierra Nevada, de Santa Maria, and its low-lying junction with the main Cordilleras, namely, the Sierra de Perija. Name the rivers draining eastward (a) through Venezuela into the Orinoco basin, and (b) through Brazil into the Amazon.

We thus see that Colombia occupies that part of the northern Andean territory where the cordillera divides into three parts. A narrow plain borders the highlands on the Pacific coast, a larger extent of low-lying alluvial plain borders the Caribbean Sea, whilst on the east the land slopes away more gradually and merges into the vast llanos and selvas of the Orinoco and Amazon basins respectively. Between the branches of the Cordilleras are to be found the chief river valleys, the main, if not sole, means of communication in a region traversed by almost impenetrable mountain regions.

As may be imagined in a country with a structure

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including on the one hand stretches of low alluvial plains and on the other hand some of the loftiest and barest plateaux in the world, and situated wholly within the tropics, every variety of climate is found.

In what other country have you found a series of climatic districts determined by elevation? Name these different climatic regions.

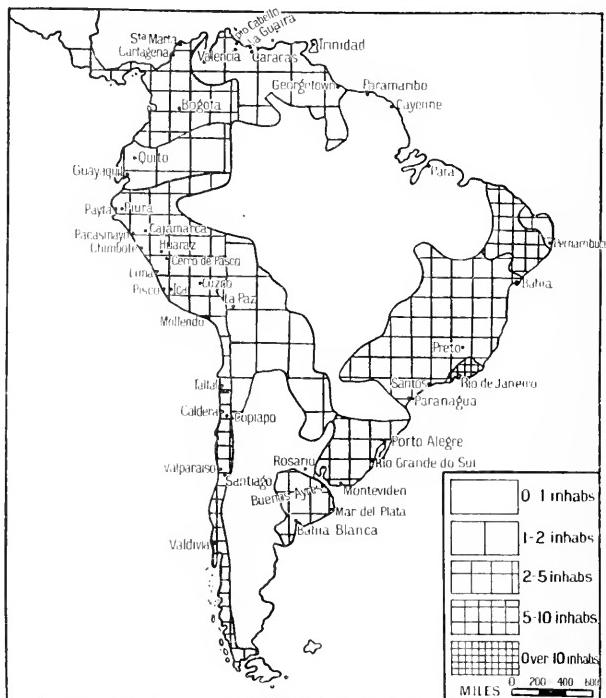


Fig. 92.—SOUTH AMERICA (POPULATION PER SQUARE MILE).

Compare with figs. 81, 83, 84, and 85, 86, and 91.

So in Colombia, the low-lying land at the mouths of the rivers forms a *Tierra Caliente*. So swampy and fever-ridden are these regions that the towns and settlements are situated mostly on low hills scattered about them.

The lower slopes of the mountains with their valleys at a height of from 3000–6000 ft. provide the country

with Tierras Templadas, with a sub-tropical or warm temperate climate.

Whereabouts—on the slopes or in the valleys—are bananas, tobacco, sugar, vanilla, and rice the main products? Where will oranges, lemons, pineapples, and coffee flourish? What is the chief cereal of these warmer regions?

While the temperatures of the Tierras Calientes and the Tierras Templadas range from 77° F. to 81° F. and from 63° F. to 77° F. respectively, the third region, at a height from 6000 to 9000 ft., provides the Tierras Frias of this country. With an average temperature of from 44° to 54° F. they correspond to our own climate, the cool temperate. Potatoes, European fruits and vegetables are, therefore, characteristic of the produce of these regions. (See Appendix, Tables X–XII.)

What cereals replace maize in this region? Which will grow at the higher altitude, barley or wheat?

Above these zones of cultivation is a fourth region reaching from 9000 ft. to the snow line (*circa* 14,000 ft.) consisting of desolate plateaux and constantly swept by icy-cold winds and rains. These are the dreaded Paramos and are to be included among the most inhospitable regions of the world, being often almost impassable because of their morasses and cold wet winds.

What is the nature of the seasons in a tropical country?

Strange to say, the wet and dry seasons are differently distributed in the north and south of the country respectively.

How often is the sun each year vertically overhead in Colombia? Account for the fact that Bogota has two seasons of maximum rainfall (see page 177).

Thus, as we have seen in a previous chapter, Bogota

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has two seasons of maximum rainfall—spring and autumn. On the other hand, the towns in the plains and near the coast have a much more evenly distributed rainfall, except in the months of December, January, and February, when the sun is vertical over the tropic of Capricorn and the rainfall is reduced to its minimum.

In which wind-belt does Colombia lie? Explain the diminished rainfall of these months (see figs. 3 and 4).

As soon, however, as the vertical position of the sun moves southward, the N.E. trades re-establish steady moisture-bringing winds. As already suggested, however, local conditions cause great variations from the normal climatic conditions.

Study carefully the following tables and compare with them the figures given for Bogota on page 177.

		Puerto Berrio	Medellin
Latitude . . .	6° 22' N.	6° 10' N.	
Height . . .	509 ft.	4652 ft.	
	Temp. °F.	Temp. °F.	Rainfall inches
January . . .	79.3	70.2	2.2
February . . .	79.1	71.0	2.6
March . . .	78.6	70.2	5.4
April . . .	78.2	70.1	7.0
May . . .	78.6	70.2	7.8
June . . .	78.8	70.1	6.6
July . . .	78.4	69.8	6.4
August . . .	78.4	70.1	5.2
September . . .	78.4	69.8	6.4
October . . .	78.6	68.7	7.4
November . . .	78.8	68.3	5.8
December . . .	79.1	69.0	2.7
Extreme variation of temp.	1.1	2.7	..
Total rainfall . . .	..	..	63.2
Average temp. . .	78.7	69	..

Which is the hottest month in each town? How does it depend upon altitude? Which town has the hotter climate? Upon

what does that depend? Find the rate of fall of temperature per 100 ft. altitude as between Puerto Berrio and Medellin and between Medellin and Bogota. Note the difference in latitude and suggest why the rate of fall is lower in the latter case. Notice the months of maximum rainfall in Medellin and Bogota respectively and observe that it corresponds roughly to the movements of the sun. How often each year is the sun vertically overhead in each of these places? How often, therefore, each year does a permanent low pressure area tend to be established? Why, therefore, are there two periods of heavy rainfall? Why should the periods of Bogota be further apart than those of Medellin? In answering this question, consider the relation of latitude to the intervals elapsing between the successive periods at which the sun is vertically overhead, e.g. of a place (a) on the equator, (b) on each of the tropics of Cancer and Capricorn, (c) on a latitude approximately midway between these.

On the south eastern side we find that in the northern section the country shares in the seasonal rainfall of the Orinoco basin, a climate which produces the open grassy plains, the famous llanos of that region. In the south, on the other hand, the streams flow into the Amazon and the country with its evenly distributed rainfall belongs to the selvas or heavily wooded plains of the Amazon basin.

The country is also well favoured in soil and geological structure. The soil on the temperate slopes of the Sierra Nevada de Santa Maria is exceedingly rich and these Sabanas, as they are called, are some of the most fertile regions of the world.

Look at the list of Colombian products and exports in the appendix and state which are produced in this temperate region. (See Tables IIIb and X-XII.)

The western part of the country consists of tertiary rock, except where quaternary overlies it on the lower regions. The central cordillera are crystalline, whilst the eastern slopes are cretaceous.

Suggest what processes may have produced this varied distribution of rocks.

With such a variety of structure it is not to be wondered at that the country is richly supplied with minerals of all kinds—coal (tertiary) ; iron ; rock salt ; gold (alluvial and placer) ; silver ; platinum ; and copper all occur in plentiful quantities, but at present are comparatively little developed.

Connect this want of development with the structure of the country.

Which is the chief river ? It is only navigable to La Dorada (nr. Honda) and again a little above the rapids. Note the position of Antioquia, the chief coal centre on the Cauca. Which minerals do you connect with the presence of quantities of red sandstone in the country ? Recall the chief mineral occurring in the red sandstone of Cheshire. In which rocks do silver, platinum, and placer gold occur ? To what extent are the crystalline rocks in Colombia accessible (see fig. 82) ?

Lead, mercury, and manganese are mined, and Colombia provides nearly all the world's supply of emeralds.

Note the positions of the following ports and towns, and observe as far as possible how the development of their industries is dependent upon their situation.

Barranquilla and its seaport, Sabanilla, or Puerto Colombia—the chief port. On which river does it stand ?

Bogota—the capital. What communication has it with the chief port ? How far is it from El Dorado, the head of navigation on the Magdalena ? Note the nearness to the capital, of Pradera—the chief iron centre, and of Zipaquira, the chief salt-mining centre (north of Bogota).

Lloro, just above the head of navigation on the Atrato. Cartagena, a less busy port than Sabanilla. Can you suggest a reason for this ? It is now connected by a canal with the Magdalena.

Medellin, the centre of the gold mining industry.

Bucaramanga, the centre for the coffee trade.

Which of the harbours have railway connections ? There is a short railway around the Honda rapids on the Magdalena.

Santa Marta—a port of growing importance in the banana trade.

How is Barranquilla well situated for cotton industry? In which part of the country can cotton be grown? Note the manufacture in the lowland towns of Panama hats from palm-leaf fibres (p. 182).

This country like all the adjacent Central American and Andean States, is liable to volcanic and earthquake disturbances.

Explain thus the name Rio Vinaigre for one of the rivers. Though vinegar contains no sulphur, what acids do contain it?

PRACTICAL EXERCISE

- (1) Make temperature and rainfall curves for Puerto Berrio and Medellin, and compare with these made for Bogota. It is instructive for purposes of comparison to reduce the temperatures for Bogota to sea-level and draw an additional curve for the figures thus obtained (pp. 182 and 177).

CHAPTER XIV

VENEZUELA

Make a careful study of a map of Venezuela. Between what parallels of latitude and what meridians of longitude does it lie? What do you infer roughly as to the character of its climate? What is the nature of its boundaries? What States border it? What is the character of the country? In which parts is it (a) mountainous? (b) plain? What large river-basin occupies a great part of the country? How does the river compare with the Amazon in length? What great gulf and lake lie to the north of the country?

A GLANCE at the contour map (fig. 81) shows us that Venezuela consists of four distinct regions. From north to south they are, respectively, the low-lying plain surrounding Lake Maracaibo; a double range of mountains running S.W. and N.E. separating this plain from the extensive and mostly low-lying basin of the Orinoco, which again rises by spurs between the main tributary channels to another mountain region which is a continuation of the mountains of British Guiana and Northern Brazil.

Naturally in a country situated in a tropical region and with so varied a contour, a great variety of climate and resulting products is found. Moreover the varied distribution of highland and lowland causes a very unequal distribution of rain. Some districts lying to the lee of a mountain range are thereby placed in what we may call a complete rain-shadow and have in consequence an arid climate, receiving little or no rain in the rainy season. The number of these districts is not large.

Look at the wind map of S. America and discuss where these arid regions can lie (see fig. 91). Which will be the wet months for the greater part of the country?

The northerly alluvial plain of Maracaibo has a warm humid climate, and some of the best known cocoa in the world is grown in this region. Sugar cane, coffee and maize, bananas and oranges, rice, tobacco, and cotton are also grown in this region at varying heights, the maize giving three or four crops a year and therefore forming a staple article of food in the country. The lower part of the basin of the Orinoco is a continuation of this region, and the river cuts its way through vast grassy plains known as llanos which at one time were quite free from bush or wood. The comparative neglect, at the present time, of cattle-grazing, for which these llanos are so suitable, is the direct outcome of internal political warfare in the State, and indeed has been accompanied by a deterioration of the land through the growth in it of a quantity of scrub.

The upper reaches of the Orinoco, on the other hand, resemble those of the Amazon, with which it is connected, and afford the same wealth of forest products.

Trace this connection on the map. Name some important forest products. Look at fig. 91 and note the cause of the difference between the upper and lower basin of the Orinoco.

Most of the low-lying plains are quaternary, but the llanos seem to have been at one time the bed of an ancient tertiary sea. The country has, however, rich mineral wealth which, nevertheless, is not much exploited.

Note the positions of the following, especially in relation to the mountains and plains respectively (fig. 81). Which of the metals are found in original crystalline rocks? Which in sedimentary? (Figs. 84 and 82).

Gold : Yumari region, but widely distributed.

Yumari is near the Callao mines of British Guiana.

Iron : Imataka, near the mouth of the Orinoco.

Coal : Naricau!, near Barcelona.

Petroleum : Orinoco delta.

Asphalte is also obtained in Maracaibo, Cumana, and Pedernales.

In connection with the presence of asphalte in these regions, note the direction of the line joining them with Trinidad. This suggests that Trinidad is an extension of the Sierra Nevada de Menda, while the West Indies generally would seem to be a continuation of the Sierra de Perija on the boundary of Colombia.

Note the position of the following :

Caracas, the capital.

Maracaibo, largest port.

La Guaira, Barcelona, Carupuno and Cupano, ports.

Ciudad Bolivar, port on the Orinoco, from which sea-going vessels carry produce to Port of Spain in Trinidad to be there transferred to ocean liners. To Ciudad Bolivar the produce is brought in light river vessels. Recall the nature of the Orinoco plain, note the slow fall of the river, the delta-like mouth, and account for the absence of a large port at its mouth.

CHAPTER XV

ECUADOR

Study on the map the exact position of Ecuador and account for its name. What are its extreme northern and southern latitudes respectively, and also its extreme longitudes east and west? What is the shape of the country? Describe its boundaries. Note that its neighbours are all larger and more powerful than itself, and suggest an explanation of the shape of the country and the fact that its boundaries have for a long period been unsettled. Note that the country is at its widest in the mountainous and populated coast regions, eventually narrowing to a point in the plains of the hinterland, where it is comparatively much less populated. What is the structure of the country? Which regions are mountainous? Which are plains? How do they lie? What is the nature of the river drainage of Ecuador? Name any important rivers flowing into the Pacific. How does the eastern drainage differ from the western? Into what river-basin does the former flow? Through which great tributary?

THUS we find that Ecuador, like all the western States of South America, falls structurally into a series of roughly parallel regions lying approximately north and south—namely, a coastal region rising gradually to the western Andean slopes, a central high tableland between two parallel ranges of peaks, the oriental and the occidental, and finally an eastern Andean slope falling down to the central South American plain, here heavily timbered and an integral part of the Amazons selvas. Each of the regions has a distinct geographical character, with clear differences of soil, climate, and, of course, vegetation.

From the contour map, fig. 81, construct an equatorial elevation.

across this State and suggest what variations in climate must accompany the changes in elevation.

The coastal region of Ecuador differs entirely from that of Peru, which, as we shall see later, has a desert character, the former having on the contrary a very moist climate.

Look at figs. 3 and 4 and explain this humidity of the climate. What winds blow across this region? What current flows along this coast? Is it a warm or a cold current? What has become of the cold Peruvian current in these latitudes? What is the character of the rainfall of equatorial regions? seasonal or otherwise?

We find that the time of the rainy season varies in different parts of the country owing to its complex mountain structure, though on the coast we find generally an unbroken wet season from December to May followed by an unbroken dry season till the next December.

Note the position of the country round Guayaquil on the north coast of the Gulf of that name. How does this region lie relative to (a) the Peruvian current? (b) the trade winds? (c) shielding mountains? Suggest why it is a desert region. Which of the following products are from the lower valleys and plains of the coastal region, and which from the higher valleys and Andean slopes—coffee, sugar cane, cocoa, tobacco, and bananas? (Table X.)

This belt of tropical growth extends to a height of some 3000 ft. above sea-level and it is in this region that the palm grows which provides the torquilla fibre from which the so-called Panama straw hats are made. The cocoa of this country, mostly grown in the Guayas basin, is of good quality and provides nearly one-third of the world's supply. Above 3000 ft. are grown maize, wheat, barley, oats, lucerne (for fodder), and in some of the sheltered valleys subtropical fruits, such as lemons and oranges.

Arrange the cereals and other plants mentioned above in order according to the height above sea-level at which they will ripen.

The Andean belt of Ecuador is a most remarkable region. It consists of a high plateau lying between two almost parallel rows of snow-capped volcanic peaks, the oriental and occidental cordilleras already mentioned, closed to the north and south by transverse ridges forming in the former instance a high "knot" of mountains. The great plateau between these ranges, some 300 miles in length, and 20 miles in breadth, is divided by Paramos, similar to those of Colombia, into three shallow depressions forming the elevated plains of Quito, Ambato, and Cuenca.

How do these lie relatively to one another ?

The level of these basins falls from north to south through the much dissected plateau of Loja to the coastal plain, the heights of these plateaux being respectively 9500 ft., 8500 ft., and 8000 ft. Of these the plain of Quito is uniformly fertile and consequently the most populous part of the country. This fertility is due to the ample rainfall of the plateau compared with the reduced rainfall of the other two basins, which are only fertile in certain locally favoured regions.

How might this difference in rainfall be connected with the difference in elevation, relative to the surrounding peaks? In a region otherwise arid how can fertile districts occur?

How are they related to the rivers flowing through the arid region?

Note the position of Quito, the capital of the country.

To what extent would you consider its situation suitable for
(a) a self-supporting country? (b) a country with a large world-trade?

The rocks of the country lend themselves to the pro-

duction of fertile soils. The western coast belt is almost entirely late diluvial and alluvial rock; less recent rocks appear in the western cordillera, while in the eastern chain is much crystalline rock. The lightness and fertility of the soil of the central plateau is due to its volcanic character, surrounded as it is by over twenty volcanoes, active and extinct.

Find the positions of Cotopaxi and Sangar, the only two now active, and of Chimborazo, the highest peak, over 20,000 ft. in height.

The lower regions of the Paramos, though completely denuded of trees, allow of a sufficient growth of grass for cattle and horses, the rearing of which is steadily increasing.

Finally, the eastern belt forms part of the whole basin of the Amazons with its dense selvas and corresponding forest products. As yet, this part of Ecuador is but little opened up.

The minerals of the country, though they are very varied and include coal and petroleum, are inferior both as to accessibility and quality to those of either of its neighbours on the west coast and are, therefore, comparatively little developed. (See Appendix, Table VII.)

Note the position of :

Guayaquil—the chief port of Ecuador, being connected by railway with Quito, the capital.

Cuenca—the centre of a stock-raising district.

PRACTICAL EXERCISE

Study the following figures showing the height and the yearly average temperature of three places in Ecuador at nearly the same latitude. Construct from them a curve to show the relation between change of altitude and of temperature.

	E1 Recreo	Quito	Antisana
Latitude . . .	0°27'S.	0°14'S.	0°21'S.
Height . . .	Sea-level	9200 ft.	13,400 ft.
Average Annual			
Temperature	74.5° F.	54.5° F.	41° F.

Is the rate of fall of temperature constant? How does it seem to vary? What is the rate of fall as between E1 Recreo and Quito, E1 Recreo and Antisana, and between Quito and Antisana? What is the average rate of fall?

CHAPTER XVI

GUIANA—BRITISH, DUTCH, AND FRENCH

Study the situation of the three South American States called Guiana. Name and describe their boundaries. How are British, Dutch, and French Guiana separated from one another? Between what latitudes and meridians does each of these countries lie? What will be their general type of climate? By what other names are Dutch and French Guiana known respectively? Name the chief rivers of each State and the capital and chief ports.

GUIANA has a special historical interest in having been first sighted by Columbus when he discovered the island of Trinidad and in having become the El Dorado in search of which over a century later Sir Walter Raleigh sailed out to the new world.

In what centuries did these voyagers live?

The three Guianas in their structure have certain characteristics in common. A low, very flat, sandy shore gives on to a belt, varying in width from 20 to 50 miles, of very low-lying river flats, interrupted only by ridges of sand, indicating ancient shore lines. By careful drainage these lands, especially in Dutch Guiana, have provided most fertile land for agricultural purposes. As much of this is below the level of high-water, dikes have to be constructed and maintained.

Consider this in connection with Dutch Guiana.

Behind this belt is a district in which the land rises somewhat to dryer land between the rivers, though in

the valleys themselves it still remains swampy and densely forested. Further inland this higher land gradually forms stretches of savannahs, grass-covered, and practically treeless. Finally, along the inland boundary lies a mountain region. As in the case of the higher plains between the rivers, these mountain regions are in parts forested, in parts grassy or entirely bare.

How does this variation depend upon the nature or condition of the soil—the climate being the same? Some of the mountain regions and plains are sandstone, some are granite. Which are the forested regions?

The most fertile region is, of course, the coastal flats, which, under a proper system of irrigation, constantly receive fresh deposits of alluvium.

The climate, as we have noted, is tropical and oceanic. What does this imply (a) as to temperature? (b) as to rainfall? (c) as to seasons? How many wet and how many dry seasons should there be?

It is interesting to note that while the coastal regions are normal, having two seasons of maximum rainfall, the inland regions have only one especially wet season, namely, the longer one from May to July, the shorter one, only known on the coast, being in December and January.

Having regard to the latitude of these countries, when would you have expected the wet season to fall?

It is indeed difficult to explain why the wettest seasons should be near the two solstices for a country which lies just north of the equator, but a glance at the following table will show that as a matter of fact the rain is fairly well distributed all the year round, with the exception of a comparatively dry season in September and October.

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Average monthly temperature Fahrenheit and monthly distribution of rainfall in inches.

		Georgetown	Paramaribo	Cayenne	
January	.	78.4	7.6	77.5	8.8
February	.	78.4	5.7	77.3	6.7
March	.	79	5.7	78	8.0
April	.	79.6	6.5	78.4	9.0
May	.	79.4	10.8	78.8	11.7
June	.	78.8	12.0	78.8	11.0
July	.	79.0	9.7	79	8.2
August	.	79.5	6.7	80.1	6.0
September	.	80.9	2.7	81.1	2.9
October	.	81.1	2.4	81.1	2.8
November	.	80.4	5.7	80.6	5.3
December	.	79	11.3	78.8	8.7
Temp. Average	.	79.3	..	79.2	..
Rainfall Total	.	..	86.8	..	89.1
No. of rainy days	.	..	177	..	204
					.. 207

Examine these figures carefully and compare the climates of the three towns. Which is likely to be the most healthy? Note that the temperature maxima do not coincide with the months of maximum rainfall but on the contrary even in some cases they coincide with those of minimum precipitation. This may perhaps be best accounted for in the very small change of temperature throughout the year.

Curves may be constructed to compare the rainfall distribution of the three towns and to compare in each town the rainfall distribution with the curve for temperature.

With such a moist hot climate, we are not surprised to find that sugar, cocoa, cotton, bananas, sweet potatoes, and manioc are the chief products.

Gold is the chief mineral product, being found in all three colonies, the British region being a continuation eastward of the Yumari gold region of Venezuela.

The only one of these three European colonies which is making progress is British Guiana, this being due to careful administration, irrigation and sanitation. The

Dutch colony, owing to want of sanitation, has shown in latter years a considerable decrease in the value of its exports, whilst French Guiana or Cayenne with its penal settlement has remained, largely owing to want of sanitation, a comparatively undeveloped colony, and is a constant source of expense to the mother country. The cutting down and clearing of the swampy forests near the coast in French Guiana would probably go far toward changing a fever-ridden locality into a well-settled colony.

Note the position of:

Georgetown, the capital, and New Amsterdam, the second town of British Guiana. These towns are connected by railway.

Chief exports: rum, gold, and diamonds.

Paramaribo, the capital and chief port of Dutch Guiana.

Chief exports: sugar and cocoa.

Cayenne, the capital and chief port of French Guiana. The famous prison island, Île de Diable, lies immediately opposite the capital.

Chief exports: coffee, cocoa, phosphates, indiarubber, rosewood.

QUESTIONS AND EXERCISES ON COLOMBIA, VENEZUELA, ECUADOR, AND THE GUIANAS

- (1) By means of rectangles—on the larger scale 1 sq. mm.=100 sq. miles and 1 sq. mm. shaded=50,000 people—compare the areas and density of population of Colombia, Venezuela, Ecuador, and the Guianas. Which is the most populous of these States? Which the least? (See Table I, Appendix.)
- (2) Compare the trade of Venezuela with that of Colombia in quantity and in the chief articles of import and export respectively. How do they compare in the total value of trade per head of population? (See Table II.)
- (3) Compare Venezuela and Colombia as to the countries with which each has most of its trade. In which case does Great Britain still appear to have the advantage over the United States? How may the opening of the Panama Canal affect these figures? (See Tables IIIa and IIIb.)
- (4) How do Colombia and Venezuela compare with one another in the production of sugar? How does the former compare with Dutch Guiana in the production per head of population? You

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will note from Table I that the population of Dutch Guiana is about one-sixtieth of that of Colombia. (See Table IVb.)

- (5) How does Venezuela compare with British Guiana in the amount of live stock, total and per head of population? Consider the climate and topography of each of these countries and suggest reasons for the differences. (See Table V.)
- (6) Compare British and French Guiana in the area of land under crops. Which has the greater area of cultivated land per head of population? (See Table VI.)
- (7) Which of these States shows a considerable production of minerals? Of what nature are they? At £4 per oz. what is the value of the production of each of these States? (See Table VII.)
- (8) What is remarkable about the comparative railway development of Colombia, Venezuela, and British Guiana? (See Table IX.)

CHAPTER XVII

PERU

Study carefully a map of Peru. Between what parallels of latitude does it lie? What are its extreme easterly and westerly longitudes respectively? Describe its boundaries and name the countries which border on it. Name the large lake which is crossed by the boundary between Peru and Bolivia. What is approximately the height of this lake above sea-level? What is the general elevation of the country? How do the rivers flow? Which great river basin in Brazil has some of its head waters in Peru? How do the rivers draining the eastern slope of the Andes differ from those draining the western slope (a) in their general direction of flow? (b) in their length? and (c) in the character and number of their outlets into the sea? Find the rivers Yapura, Putumayo, Marañon and its tributary the Ucayali, Jurua, Parus, and Madeira. Which of these help to form boundaries? What river drains into Lake Titicaca? Trace the drainage of the lake further south into Bolivia through Lake Aullagas and finally into saline marshes on the lower ground to the south.

As in most of the countries lying to the west of South America, the dominant factor is the great cordilleran chain, producing as it does, such great variations in elevation. Peru, therefore, is also divisible into a series of belts, roughly parallel with the coast and three in number—a coast zone, the Andine zone, further divisible into three groups, (a) western foothills and mountain slopes, (b) tablelands surrounded by high snow-clad peaks, and (c) the eastern slopes, and finally the Amazonian forest region.

The main differences between these regions are, as might be expected, climatic in character.

Look at figs. 3 and 4 and 86 to 91 and note the position, the isotherms, the prevailing winds, and rainfall of Peru.

We observe that the country is in the region of the south-east trade winds and thus the greater part of the country lying west of the Andes is rainless, whilst the eastern and mountain regions have an ample rainfall. On the actual coast even the rainfall is negligible, for the winds that blow from the sea are from the south and cooler than the land. On reaching the land they are warmed and become, therefore, relatively drier. This effect is largely caused by the cold Humboldt current that flows up this side of the Pacific from Antarctic regions. (See Chap. I, and fig. 5.)

What current in the North Atlantic is similar in character ?
(See Chap. I.) What influences has it upon the climate of parts of North America ?

The Humboldt current has its greatest climatic influence during the southern winter, when the sun is vertical over the tropics north of the equator. The coastal region of Peru then derives a little moisture, though very small in amount, from the almost continuous fogs that occur during this time, namely, from June to September, when the cooling influence of the current is sufficient to cause a constant if slight precipitation. The sky is often obscured for weeks at a time by a fog which is very occasionally accompanied by a slight drizzling rain called *garua*. This comparative absence of available moisture enables us to understand the peculiar character of the Peruvian coastal plain, which from north to south consists of a series of stony and sandy deserts

known as *sebanas*, and crossed from east to west by fertile river-plains.

Whence do these rivers take their origin ?

The actual origin of Andean rivers is twofold, (a) from the glaciers and snow fields of the highest peaks and (b) from the rains on other high, but snow-free, peaks.

Why do both of these sources maintain the rivers at flood during the same season ? When do the snows melt most rapidly ? When is the strongest barometric minimum produced to cause rain ? Does this coincide or not with the season at which the fogs occur ?

Thus we see that the hottest season of the year is the one in which the fertile river valleys are best supplied with water for irrigation purposes, whilst in the season when the rivers are at their lowest the sky is for long periods obscured by fog.

Show how this is an advantage in both ways for agriculture in the watered valleys. At which season is evaporation greatest and irrigation most needed ? Suggest some likely products of these irrigated tropical valleys.

As we travel inland and leave this coastal plain with its arid *sebanas* intersected by fertile valleys, our way leads us still through well watered and fertile valleys, now, however, separated from one another by the rocky spurs of the Andes. These are the western foothills, in the valleys of which maize, vines, and temperate fruits grow and in the crystalline rocks of which lies the mineral wealth of the country, almost the most varied in the whole world, including, as it does, gold, silver, lead, copper, mercury, zinc, iron, manganese, mica, and even coal (fig. 93.)

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Can you suggest why most of these, except the gold and silver, are so comparatively little worked? (Figs. 93 and 95.)

In the coastal region are also found some valuable

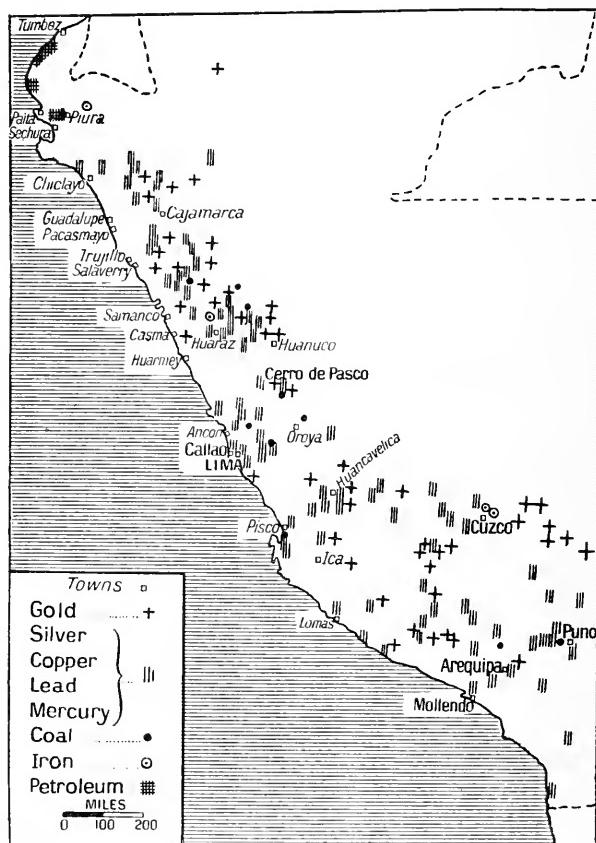


Fig. 93.—CHIEF MINERAL REGIONS OF PERU.

Compare with fig. 95 and note which regions are best supplied with facilities for transport.

minerals, especially deposits of nitrates and other salts which would be removed by solution in a moist climate.

How have these probably been formed? What part has evaporation taken in their formation?

To the east and above these rich foothills lie the great elevated plateaux, the *punas* of Peru. At an elevation of from 11,000 to 14,000 ft. and with a cool temperate climate, these punas, the highest habitable part of the

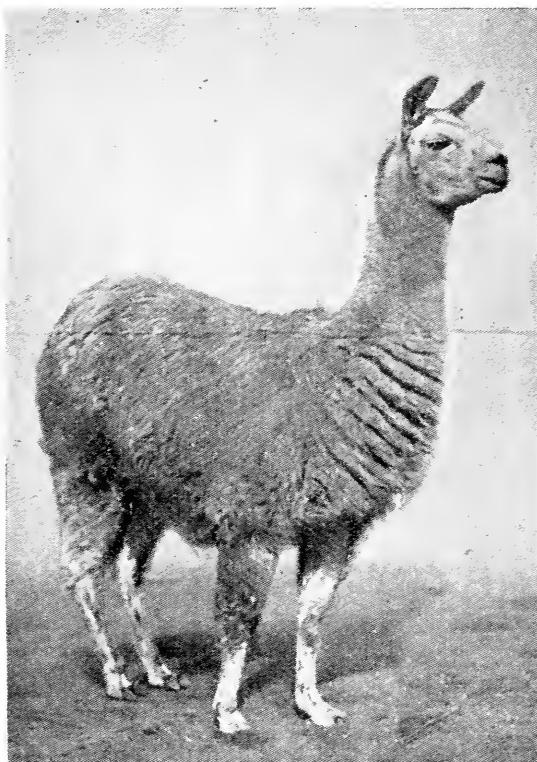


Fig. 94.—LLAMA.

globe, consist of great treeless wastes with mountain grass as their only vegetation. In the western section a system of inland drainage affords vast salt swamps and inland lakes, whilst further to the east the punas are intersected by the fertile valleys of the head-waters of the Amazon's basin. The crop which grows at the highest altitude in the Andean regions is alfalfa (lucerne) and is used

as fodder. Consequently on the higher slopes of the foothills where it grows and in these punas, grazing is the only occupation of its inhabitants, the native descendants of the once famous nation of the Incas. Peru is, in fact, famous for some of its wool-bearing animals, the llamas, alpacas—both domesticated—and the free roaming vicuña. The llama is of great use to the native as a beast of burden and also, as in the case of the nomadic tribes of Asia, its dung is used as fuel.

Connect this latter fact with the character of the country, its inaccessibility and the undeveloped state of the mineral resources of Peru.

With the exception of the few head-waters of the Amazon basin, these punas are separated from the eastern montana of Peru by inaccessible snow-clad peaks. Very different indeed from the bare western foothills are these eastern slopes, thickly wooded and well watered not only with the rivers from the higher regions, but also with an ample local rainfall. Rubber, cabinet woods, cinchona, the source of quinine, also called Peruvian bark, are among their chief products.

For what reason is the bulky timber, though of the best and rarest quality, at present of comparatively little value to the world ? How can it become more so ?

The wonderful navigability of the Amazon for river steamers brings this region into fairly ready touch with the outside world for products of small bulk. In this montana region, as on the slopes of eastern Peru, are grown coffee, cocoa, tobacco, and a plant called coca, from which the drug cocaine is extracted. Coca leaves are chewed by the natives of the high puna regions as a

stimulant to aid them in resisting the languor resulting from living in such elevated regions.

What is the difference in barometric pressure at these heights—1 inch for every 900 ft.? What effect must thin air have on breathing and on the heart, especially during exertion?

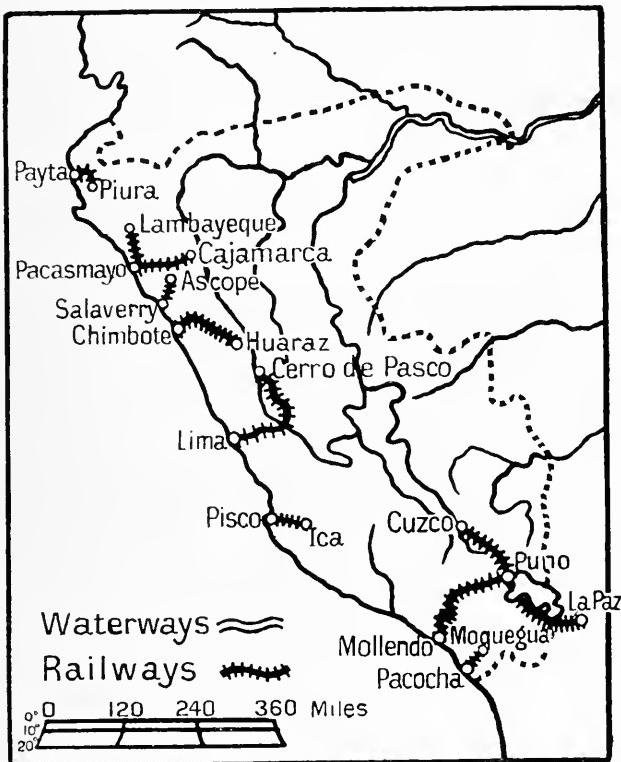


Fig. 95.—PERU.
CHIEF MEANS OF COMMUNICATION.

Sugar cane, cotton, rice, and maize, with sometimes three crops of the latter, are the chief products of the country.

In which region are these grown? and also vines and olives?

Most of the guano—the rich deposits of bird manure

on the islands off the coast and on the coast itself—were handed over to Chile after the close of the war in 1902. A few deposits, however, remained in the possession of Peru and still form a profitable source of income.

As in the case of all the South American States, railways have been but little developed and communication on the western side is mostly by coasting steamers and on the east by river steamers.

Look at fig. 95 and note what towns are connected by railway.

Where does the railway cross the Andes partially or completely?

Observe the limits of navigation on the eastern side on the head-waters of the Amazons basin.

Observe the position of Lima, the capital. How is it situated relative to Cerro de Pasco, the chief mining centre? How are they connected?

Look at the map showing the position of the chief coal deposits and explain why in spite of good quality coal of all kinds having been found, only that near the coast is developed.

Note the positions of each of the following towns and explain its industrial or other importance:

Cuzco—a wool centre.

Lima—cotton and woollen manufactures.

Arequipa—hot springs and borax. What connection do you trace between these?

Callao—chief port of Peru.

Mollendo—second port of Peru, connected by rail with Bolivia via Arequipa.

Trujillo—sugar export.

Pisco—port near the Chincha guano islands.

PRACTICAL EXERCISE

Compare the climates of Lima and Arequipa as shown in the following table:

Town	Average Annual Temperature	Average Annual Rainfall	Latitude	Altitude
Lima . . .	66.5	1.8 inches	12° 4'	514 ft.
Arequipa . . .	56.3	5.8 inches	16° 46'	7500 ft.

Explain the differences in (a) temperature, (b) rainfall. Most of the rainfall of Lima is due to the garuas. In no one month is over half an inch registered.

Note the position of La Merced almost in the same latitude as Lima, in 11° S. and $75\frac{1}{2}$ W., height 2290 ft. Its rainfall is 14 inches a year. Account for the difference. In doing this consider on which slope of the mountains La Merced lies.

CHAPTER XVIII

BOLIVIA

Make a careful map study of the State of Bolivia. What peculiarity in its situation distinguishes it from all the other South American States, except Paraguay? By what countries is it bounded? Between what latitudes does it lie? What are its extreme easterly and westerly longitudes? What is the nature of the country? To what extent is it respectively a mountainous region, a lofty plateau, a low-lying plain? What is the character of its river drainage? To which ocean and through which great basins is the country drained? Name the main tributary of the Amazon through which the Bolivian drainage of this basin flows? Into what basin do the Pilcomaya and Bermejo flow? Note the position of the Chiquitos mountains.

WE thus see that Bolivia is not, as is so commonly imagined, a wholly mountainous country, for fully three-fifths of its area consists of low swamps, forest lands and alluvial plains, corresponding in character to the remainder of the Amazons basin (fig. 81.). The remaining two-fifths consist of high mountain peaks and lofty tablelands, built up as usual by parallel series of mountain chains, running approximately north and south, and connected here and there by knots of lofty intersecting ridges. At this, the widest part of the Andean chain, there is thus formed the great tableland or Puna of Bolivia, stretching from the knot of mountains north of Lake Titicaca to the Argentine frontier in the Serraina de Lipez.

Measure roughly the length of this plateau. What is the rate of its slope if it falls away to the south 1000 ft. in 500 miles?

This is a vast basin of inland drainage pouring its waters into Lake Titicaca, the highest lake in the world, situated at a height of 12,600 ft. above the level of the sea.

What other country borders on this lake? Name any ports on its banks.

The overflow from this lake, it will be seen, follows the southerly slope.

By what river does it flow out? Into what lake does it pour? Find Coipasa, the salt swamps in which this inland drainage eventually loses itself. What becomes of the water? How do you account for the excessive evaporation? How do you connect it with (a) the decrease of rainfall as we travel south, (b) the presence of desert conditions in this region? Observe that this desert of Lipez is practically continuous with that of Atacama.

The climate is, of course, very varied and wholly dependent upon elevation, affording several regions of production. The lowest are the river plains, known to the natives as *Yungas*, with a high temperature and a moist climate—a typical tropical region of dense forests with indiarubber as its chief natural product, and sugar and rice as the chief agricultural products.

Note the positions of Santa Cruz and Trinidad in this region.

Above these are the *Valles*, the lower eastern slopes of the cordilleras, with a rich rainfall and a sub-tropical climate. Tobacco, coffee, cocoa, and the coca plant thrive in these, at heights from 5000 to 7000 ft. As we pass higher into the mountain regions, into the so-called *Cabezas de los Valles*, we pass through the region of warm temperate plants, e.g. figs, to the temperate region of maize and then wheat, vegetables, and summer fruits.

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Note the position of Cochabamba, the second largest city in the republic, situated at a height of about 7800 ft., and of Sucre (formerly Chuquisaca) nearly 8800 ft. above the sea. What differences would you expect between these two townships (a) in climate? (b) in products? Can you suggest why the latter should have a greater rainfall and also why its climate should be preferred by Europeans?

The climate renders the highest region, that of the *punas*, somewhat bleak and inhospitable, partly because of the low temperature and partly because of the irregular and small rainfall.

Account, therefore, for the region being mostly used for cattle-rearing. Why are potatoes the chief vegetable, and barley the chief cereal? Note the position of La Paz, the capital, at a height of over 11,000 ft.

Can you suggest why with the opening up of the country the population of La Paz is decreasing? Consider its accessibility (a) to the chief regions of production, (b) to the coast.

The country is rich in mineral wealth, in silver, copper, and also gold, lead, zinc, and borax. The copper is found in the more recent and westerly sandstone, while the silver and gold are derived from the older eastern crystalline rocks.

Look at figs. 84 and 85 and discuss how these ores can be exported. How can they be brought to Puno and Mollendo? Account for the discovery of gold in the eastern plains. What is the character of this gold? How has it been brought there?

The chief agricultural districts are the llanos of Mojos, Guarayos, and Chiquitos, in which excellent stock-rearing is carried on, with its accompanying trade in dried meat, hides, and skins.

Discuss the existence in this region of a native trade in such home-made goods, as woollen clothing, cigars, candles, soap, sugar, and wines.

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Note the positions of the following :

La Paz—capital.

Sucre—a provincial capital and centre of trade.

Cochabamba—a provincial capital and mining centre for lead, zinc, and borax.

Oruro—a provincial capital and mining centre for silver, zinc, and mercury.

Corocoro and Chacarilla—mining centres for copper.

Potosi, Aullagas, Poopo, Porco, Portugalete, Huanchaca, and Colquechaca—silver mining centres.

PRACTICAL EXERCISE

Study the following table :

Name	La Paz	Cochabamba	Mollendo (Peru)
Latitude . . .	16° 30' S.	17° 20' S.	17° 5' S.
Height . . .	11,200 ft.	7800 ft.	80 ft.
Maximum Temp. . .	52.7° F.	68° F.	71.0° F.
Minimum Temp. . .	44.0° F.	57° F.	59.4° F.
Average Annual Temp. . .	49.0° F.	63° F.	65.0° F.
Rainfall . . .	23.2 ins.	18.2 ins.	0.8 ins.
Rainiest month or season . . .	Dec. and Jan.	Dec. and Jan.	February

Note the difference in average annual temperature as between La Paz and Cochabamba and explain the cause. What is the rate of fall of temperature for the decrease in altitude—express this roughly in number of feet per 1° F. How does this figure compare with others you have similarly observed? What is the rate of fall as between Cochabamba and Mollendo, almost in the same latitude? Can you suggest why the difference is so much less? To what moderating influence is the climate of Mollendo subjected? To what permanent cooling influence? (See fig. 5.)

CHAPTER XIX

CHILE

Study carefully the map of Chile and state between what extremes of latitude and longitude it lies. How is it peculiar in this respect? What is the shape of the country? What country of Europe has a similar shape? How do Norway and Chile compare in shape and situation? Compare roughly from the map the relative length of the two countries. Describe the boundaries of Chile. How many States lie along its borders? What is the nature of their separating boundaries? What is the character of the elevation of the country? How does it alter from north to south? What would you conclude as to the general character of the rivers? Account for the small length of navigable waterways in the country. What is the nature of the coastal outline (a) in the north? (b) in the south?

THUS we discover that this long narrow coastal country, extending from tropical to cool temperate climes, falls into three geographical regions. In the north the great Andean chain, which forms the eastern boundary of the country, slopes slowly to the coast, where it still has an elevation of some 800 to 1500 ft.

What do you observe in the map as to the number of rivers in this region?

A more detailed study of the map will show that to the south this gives way to a much more varied surface contour.

Connect this with the increase in the number of rivers in this section.

The plateau has now become a central well-watered

plain, lying north and south and bounded on the east by the great cordilleras and on the west by a lower lying coastal range. Finally further south the elevation of the mountains gradually gets less and they approach the coast, giving the latter a fjord-like character.

Corresponding to these three divisions are three distinct climatic regions.

Compare carefully the rainfall map of Chile (fig. 96) with the isotherm maps of South America (figs. 86-88) and the wind chart of the Pacific (figs. 3 and 4).

To what extent does (a) the sea-level temperature, and (b) the rainfall, vary with the latitude?

How does the temperature compare with corresponding latitudes on the east coast?

To what is the cooler character of the west coast due? How are both the temperature and the rainfall of the different parts of the country dependent upon (a) the Humboldt current? and (b) the direction of the prevailing winds?

Thus we see that while the climate, as in Peru, is cooled by the Humboldt current there is a progressive variation from north to south, falling into three main divisions or belts—a northern quite arid hot belt, a central subtropical belt with moderate rains and a southern temperate belt with a heavy rainfall.

You are now in a position to account (a) for the situation of the desert of Atacama, and (b) for the absence of great rivers in the northernmost belt of Chile.

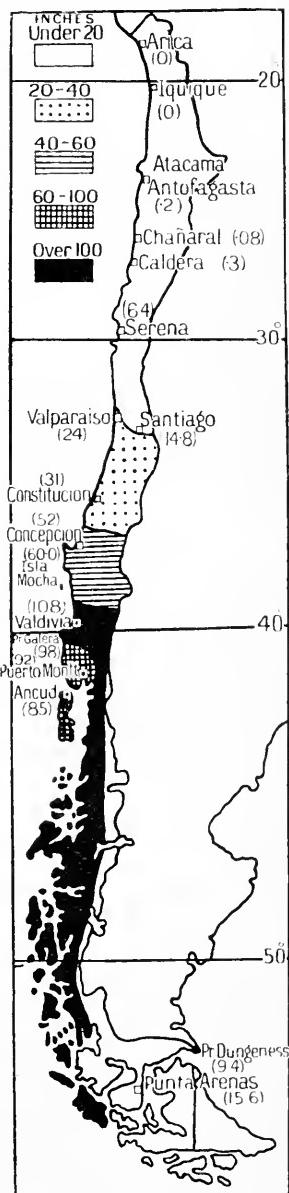


Fig. 96.—RAINFALL.

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The great desert of Atacama has proved of value to Chile in more ways than one. Historically it has been

a most effective boundary, especially in the earliest times, when it set a southern limit to the extent of the Spanish dominion in Peru. Commercially it has been and still is the greatest asset the nation possesses. The vast deposits of salts, chiefly saltpetre and common salt, which lie almost immediately under the surface, are and will be for many years to come a vast source of annual income not only to the companies (largely British) which exploit these minerals, but also to the government, from the tax placed on all the salt exported.



Fig. 97.—MINERALS.

Suggest how these deposits may have been formed. What part has in the past been played by (a) either the sea or the rivers from the mountains? (b) excessive evaporation? Connect this latter with the comparatively flat and undissected nature of the plateau and the absence of great river-mouths on the coast. Having regard to the exceedingly soluble character of saltpetre, by what agency could these deposits in a dry climate have become covered over?

A glance at the map will show that the mineral wealth of Chile is not by any means confined to its nitrate deposits. At one time there was a great source of wealth in the guano, the bird manure and remains deposited during

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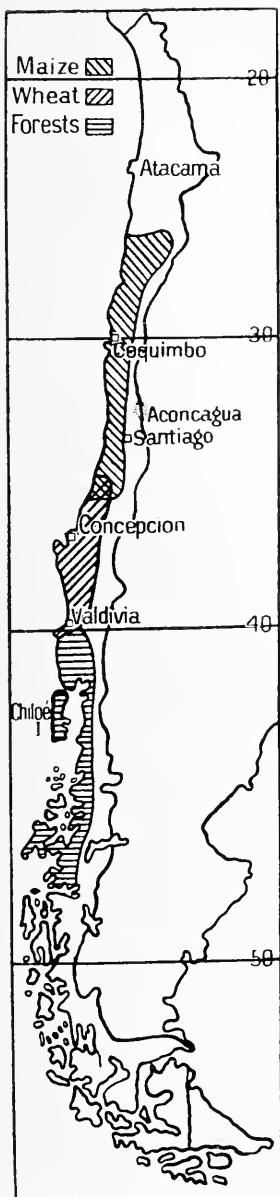


Fig. 98.—CEREALS AND FORESTS.

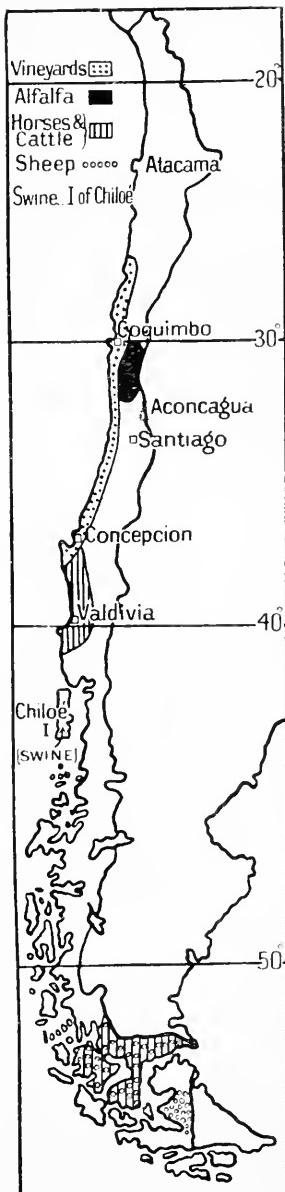


Fig. 99.—CATTLE AND VINES.

MILES
20 40 120 240 360
60°

thousands of years on the rocky islands near the coasts, but these have gradually become almost exhausted.

Find the Chincha Islands, which have in the past been the chief centre of this trade.

Ores of all kinds are found in different parts of the country, chiefly copper, silver, and gold. Of these the richest are the copper mines of the northern desert region. Iron mining has as yet not been developed, though coal is found in several regions.

Account for the coal being lignitic and tertiary. In answering this question, consider the relative ages of the eastern and western mountains of South America. Connect the position of the silver mines on the mountains with their volcanic character, having regard to the presence of so much tertiary rock in this region.

Study the mineral map and note the situations of the chief mining districts. Account for the export of copper ore from Caldera and the smelting works at Lota.

Coal of good quality for engineering has to be imported chiefly from Australia though also from Great Britain.

With what minerals do the coal ships return loaded ?

A comparison of the climatic and the vegetation maps will show that the central climatic region of Chile is the most productive and affords the most suitable home for man. The climate of this region is indeed most delightful, perhaps most like that of Southern Europe, with its brilliant skies and either a moderate rainfall, as on the coast, or ample rivers for irrigation, as in some of the inland regions between the coastal range and the Andes.

Discuss the distribution, in fig. 98, of maize and wheat, comparing it with fig. 96.

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As we travel further south, oranges and lemons, olives and figs give place to apples, pears, plums and cherries, and grazing land abounds. Accompanying the change in temperature which gives rise to this, is a rapid increase in rainfall, such that the whole of the western coast of southern Chile is covered by dense primeval forests as yet scarcely explored. (Compare figs. 96 and 98.)

Finally, in the far south-eastern regions, protected from heavy rains, is a region of comparatively scant herbage suitable only for sheep grazing, and, geographically speaking, a continuation of the corresponding Argentine region.

It is therefore easy to understand why the central region of Chile is the most densely



Fig. 100.—RAILWAYS.

populated and, politically as well as geographically, the centre of the country.

Discuss the situation of Santiago and its chief port Valparaiso. Note the positions of the following towns and ports in connection with the chief trade and industries of the country.

Nitrate ports. Pisagua, Iquique, Patillos, Mejillones and Antofagasta, Taltal, the last named being the chief port for the copper and silver of this region.

The Caracoles silver mines (10,000 ft. above sea-level).

Which of the nitrate ports are connected with Bolivia and serve for the export of Bolivian tin ?

Valdivia—hides and timber exports.

Magallanes—wool export.

Copiapó—copper and gold mining.

Compare fig. 100 with fig. 97 and note which of the chief mineral regions are well supplied with railways.

QUESTIONS AND EXERCISES

- (1) Draw rectangles—scale 1 sq. mm. = 100 sq. miles and 1 sq. mm. shaded = 50,000 people, to compare the areas of Chile, Peru, and Bolivia. Which is the most densely populated ? Which the least ? Discuss the reasons for this. (See Table I, Appendix.)
- (2) Compare these States as to the value of their (a) total trade, (b) exports, (c) imports, and as to the chief articles of trade in each case. Explain these last. By what two routes do the exports of Bolivia reach the coast ? Having regard to the districts where minerals and rubber respectively are found, suggest why the rubber and minerals are exported via the east and west respectively. (See Table II.)
- (3) Suggest why Great Britain still supplies a greater part of the imports of these countries than U.S.A. To answer this, consider (a) which country has the more shipping, (b) which is the industrial "coast" of the United States. How will the opening of the Panama Canal be likely to affect the situation ? (See Table IIIa.)
- (4) Compare Chile and Peru as regards the production of cereals. Which produces more wheat, which more maize ? Account for the difference. (See Table IVa.)
- (5) What other products are produced in any of these countries ? Account for the fact that Peru does not import proportionately so much cotton as the other States. (See Table IVb.)

- (6) How do Chile and Bolivia compare together and with other countries as to the number of domestic animals per head of population? (See Table V.)
- (7) What are the chief minerals mined in these countries? How do they compare with those of other countries of North and South America? (See Table VII.)
- (8) Compare these States as regards relative railway development. In what way or in what regions has development in the different countries been affected by (a) climate? (b) situation? (c) the nature of the country? (See Table IX.)
- (9) Why is Chile likely always to be more or less dependent on a shipping trade?
- (10) From fig. 96 select five towns, determine from a map their exact latitude and plot a curve to show how the rainfall varies with the latitude.

CHAPTER XX

BRAZIL

Make a careful study of the map of Brazil. Between what latitudes does it lie? In which zone of the world does most of the country lie? What are its extreme westerly and easterly longitudes respectively? In what latitude does its greatest width east and west lie? What will be the greatest possible time difference? Calculate the time difference between Pernambuco and Tabatinga at the boundary of Colombia, Peru, and Brazil. Name the boundaries of Brazil. By how many South American countries is Brazil bounded? Which States are not bounded by Brazil? Compare the boundaries of the different countries. How far are they natural, *e.g.* rivers or mountains? Which country is separated from Brazil by the most perfect barrier? How do the high and low lands of Brazil lie relatively to one another? (See fig. 81). How many systems of river drainage are thus formed? Which is the largest river system of the country? What river system drains the mountains to the south? What is the nature of most of the coastal rivers between the outlets of the Amazon and Plate Rivers? How do their length and direction show the character of the coastal plain? Which river drains the centre of the eastern plateau out to the east coast?

THUS we see that Brazil, one of the largest countries of the world lies almost wholly in the tropics and consists in the first instance of two distinct regions, namely, a great dissected plateau on the east and south-east, almost encompassed to the north-west and south by two vast river plains, the basin of the Amazon separated by a comparatively low watershed from that of the Plate River and its tributaries. Besides these distinct regions the Amazon basin is bounded on the north by the southern slopes of the Guiana tableland and between the great

eastern plateaux and the ocean is a long strip of coastal plain of varying, but never very great, width, except in the south, where it opens out to form the plains of the State of Rio Grande do Sul. Between the lower Amazon and Venezuela lies a slowly elevating plain which is of a semi-arid nature.

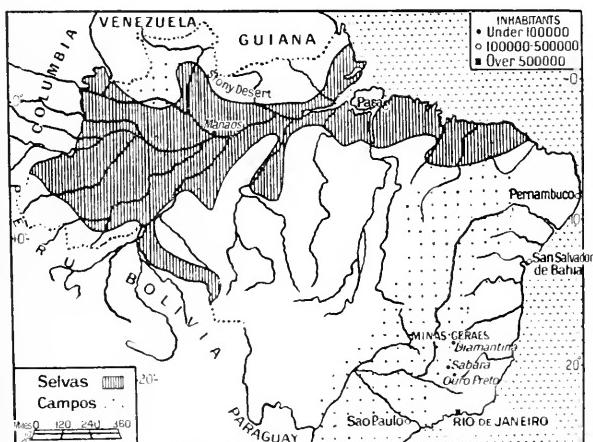


Fig. 101.—BRAZIL: SURFACE.

A rough sketch map showing the almost continuously wooded region of the Amazon basin and the region over which campos are scattered.

Look at figs. 89 and 90 and state which is the moist and which the dry season of the year for this region. Would this plain have so dry a season if the Guiana highlands were not there? Consider the latitudes between which Brazil lies and explain why almost throughout this vast country the climatic considerations resolve themselves into questions of wet and dry seasons.

These semi-arid plains, which have a rapid growth of grass in the moist season and are in consequence only suitable for grazing, are known as *campos*. Owing to the tropical character of the Brazilian climate with its seasonal rains, and to the coastal distribution of highlands, these

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campos are quite widely distributed throughout the country.

Look at fig. 101 showing the distribution of arid and fertile tracts in the country, compare it with the rainfall map (fig. 91) and the wind maps of South America (figs. 3 and 4) and account for the position of the arid tracts.

Though, as we thus discover, desert and semi-desert regions lie to the north and south respectively of the

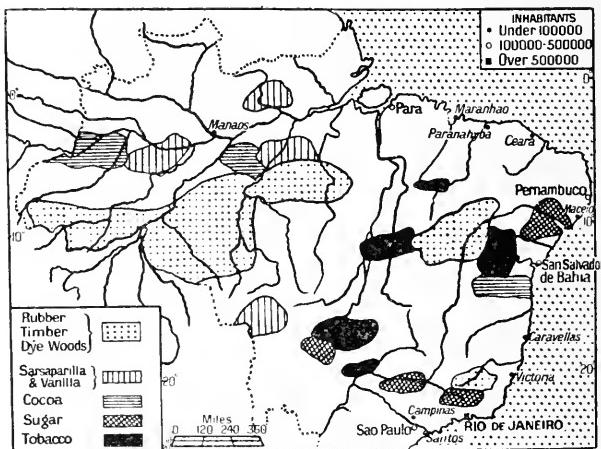


Fig. 102.—FOREST PRODUCTS, COCOA, SUGAR,
AND TOBACCO.

Compare with figs. 81 and 86-91, and account for the distribution of these products (see Appendix, Tables X-XII).

Amazon, the great plain in which it flows is one of the most fertile and most densely forested regions in the world.

What must be the character of its climate? If it has two seasons, can the one season be absolutely dry? (See figs. 89 and 90). Measure the direct length from mouth to source of the Amazon; also the extreme width of the area drained by its tributaries. Roughly estimate from this the area of its river-basin.

This vast river—at places itself several miles wide and thus more like a vast lake than a stream—must with its

tributaries offer a large surface for evaporation. Thus the air at all times, at even the driest season of the year, is sufficiently moist to encourage the growth of trees. In the most arid regions of the world, if a stream flows through any part of it, even one which eventually evaporates in an inland marsh, it is lined with trees on its banks, the extension of which on either side of the river depends upon its width and permanence. It is small wonder then if, on this low-lying plain, with its close network of sluggish but ample rivers the lines of trees expand into continuous forests, the famous *selvas* of South America, and encourage a rainfall that is fairly evenly distributed throughout the year.

Look at figs. 86 and 91 and discover the nature of the actual climate of this river basin.

We see that the climatic conditions of this region are typical of equatorial regions open to the influences of the sea, namely, it is a region of moist heat.

Study the table in Question 1, page 229, showing the annual temperature and the monthly rainfall of Manaos. How far is it from the sea? What is the direction of the prevailing wind in these latitudes? (Figs. 3 and 4). What is the total rainfall of the whole region and of Manaos? How is it distributed over the whole region and Manaos during the year? (Figs. 89-91.) What is the difference in temperature between the hottest and the coolest months? Compare this with the comparatively even distribution of the rainfall. In which months is the rainfall heaviest? How can this be accounted for by the position of the sun during these months? Why is so low and permanent a barometric minimum established over the Amazon basin?

You are now in a position to explain the flooding of the river (called by the natives *Entente*) from November to June, and the alternate low water (*Vasante*) which is at its lowest in September. This flooding of the river is productive of important results. The long continued

high water enables navigation to be maintained fairly regularly throughout the year, though it has its dangers for the river steamers in bringing down huge broken trees and also in concealing shallows and snags.

Note the position of Iquitos, a port of the Amazon 2500 miles from the mouth. The Rhine is navigable for 565 miles. Compare on the map of Europe how far from the west coast a navigable river such as the Amazons would carry trade.

Again, there are three grades of forest growth dependent upon the amount of this annual flooding. At the edge of the low water course where most frequent flooding takes place grow the rubber trees, for which Brazil has so long been famous.

Note the position of the port of Para, and account for the name Para rubber.

Beyond this on either bank of the river and of its tributaries is a region which is only flooded at the highest water mark—and consequently a region of palms. Higher than this and above the actual flood level (the Tierra Firme) there extends for hundreds of square miles a wonderfully timbered region inhabited only by native " Indians " and with its resources, commercially speaking, almost undeveloped. From these and similar forests are obtained splendid timber and other forest products, e.g. Brazil nuts, vanilla, dye woods, sarsaparilla, etc. (fig. 102). (See also Tables X-XII.)

One of many interesting features in connection with the Amazon River is the Pororoca, a bore which occurs only at new and full moon.

At what intervals of time does this bore occur? Recall the causes of tides and the conditions favourable to the formation of a bore. Why should it appear especially at new and full moon? What is the character of the tides at those periods?

Between Iquitos and the mouth of the river are over a dozen settlements, of which the largest are Manaos and Para.

It is impossible to discuss the physical features of any region or State of Brazil apart from climatic considerations. Thus, while the vast dissected tableland is perhaps the most conspicuous of the remaining parts of Brazil, the belt of lowland between the highlands and the coast is the most fertile region and therefore one of the most important.

In these well-watered lowlands with generous rainfall and high average temperature sugar, cocoa, and now rubber (in plantations) are cultivated, and on the slightly higher ground is cultivated some of the finest coffee of the world. Cotton is grown on some of the alluvial land near the river mouths.

The highlands themselves afford a greater variety of climate, consisting, as we have already noted, of high plateaux (*chapados* or *chapadas*) intersected by deeply eroded river valleys. These plateaux, varying in height from 2000 to 3000 ft., are either wooded, campos, or completely arid, according to the extent to which the coastal range cuts off the moisture-bearing winds from the Atlantic.

Look at fig. 100, compare it with fig. 81 and with the atlas, and discuss the situation of these different regions. Note the position of the three regions of erosion, the Tocantius-Araguaya basin, the São Francisco and the Parana—also the Paraguay, Xingu, Tapajos, and Guaporé.

In the south the chapadas have a moderately moist temperate climate and are among the most fertile and most richly forested regions of Brazil.

How far is this favourable climate due to (a) latitude ? (b) altitude ?
(c) situation relative to the sea ?

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As we travel farther north into the more tropical regions, all but the coastal plateaux become more and more arid, providing campos or stony deserts according to their rainfalls. The river slopes are, as a rule, well wooded.

Look at the various product maps, figs. 102-104, and discuss the various regions for (a) grazing, (b) coffee plantations, (c) rubber, (d) sugar, (e) cocoa, (f) cotton.

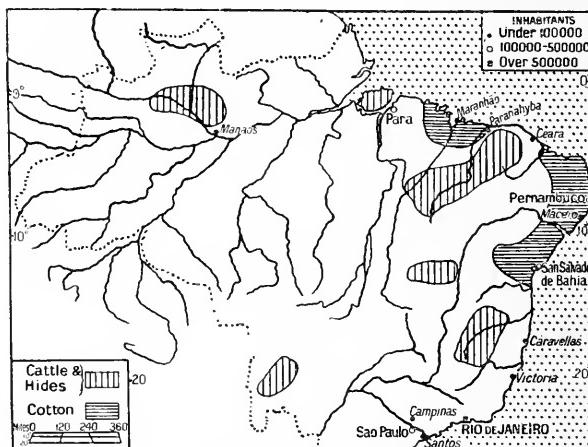


Fig. 103.—GRAZING AND COTTON LANDS.

Compare as before with figs. 81 and 86-91, and Appendix, Tables X-XII.

One of the most peculiar natural products of Brazil is the Yerba or Maté tea, a drink made from the leaf of the *Ilex* tree. It is sometimes called Paraguayan tea, but it is grown more in Brazil and is drunk throughout the country.

Another peculiar preparation of an article of food is the jerked beef or *Xarque*, which is a sun-dried form of beef. This, like the Maté, is also distributed and used all over the States of Brazil.

How might the necessity for drying and preserving the meat be due partly to the climate and to the uneven distribution of the campos

and other grazing grounds? Reconsider this question later in discussing the chief modes of intercommunication and the difficulties of transport.

It is, however, not only in the soil and its products that Brazil is richly endowed. At one time Brazil was the chief and almost the only source of the world's supply of diamonds, and also an important source of the world's gold. Other precious stones and all the well-

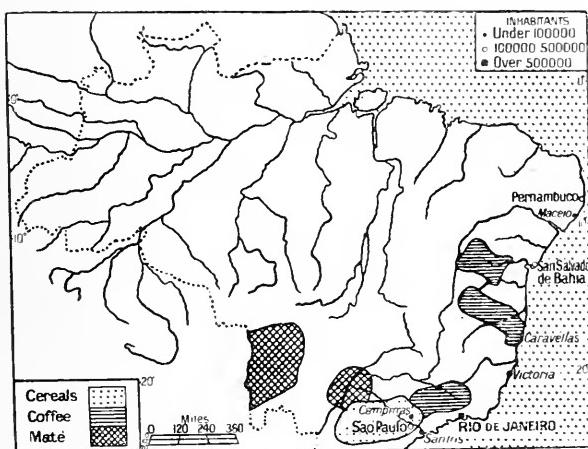


Fig. 104.—CEREALS, COFFEE, MATE.

Compare as before with figs. 81 and 86-91, and Appendix, Tables X-XII.

known metals are present in quality and quantities worth mining, but up to the present iron and manganese are the most exploited. (Figs. 83 and 84.)

Find the State of Minas Geraes (General Mines) in which almost all these mineral products are found. Account for the names of some of the towns, e.g. Diamantina, Ouro Preto (Precious Gold). Look at the map of communications (fig. 85) and state the name of the chief port of this district.

The iron has not been at all fully exploited because of the absence near it of fuel and limestone. Coal,

apparently of tertiary age, and as might therefore be expected also, bituminous and of inferior quality, is mined at the southern end of the plateau in Rio Grande do Sul and Santa Catharina.

Recalling the geological structure of the plateaux, account (a) for the position of this coal, (b) for its absence elsewhere.

Petroleum has been found, but at present it is not being produced in any considerable quantity.

On the northern coast of Bahia are sands consisting of monazite, an ancient crystalline rock from which the rare earths are derived that are used in the manufacture of incandescent gas-mantles.

Thus we see that both in agriculture and mining the resources of Brazil offer almost unlimited scope for further development. In both directions the difficulty has undoubtedly been one of intercommunication.

How has the nature of the country tended to prevent the development of communication, (a) as regards area of and distance between the chief regions? (b) as regards natural barriers between them? Which are the only navigable rivers?

That the nature of the country has prevented a linking up of the different regions is shown by the fact that the bulk of the transport of the country is still done by a coastal shipping trade. Until quite recently the railway systems starting from each of the ports were *totally* disconnected from one another, and as there are no inland waterways joining the different hinterlands, the coastal trade has been the only possible means of transport.

Observe this on the railway map and, comparing it with the maps of productions, note the positions and trade of the following ports: Rio de Janeiro, the capital, situated on one of the finest harbours in the world—exports very general produce, tobacco, coffee, cocoa, mineral products.

Pernambuco—the chief sugar port.

Bahia—tobacco, coffee, cocoa, sugar.

San Paulo—tobacco, coffee, cocoa, sugar.

Rio Grande do Sul—skins.

Santos—this port has the largest coffee export in the world.

Para—rubber.

The northern part of the coast is very sandy and much blocked by coral and other reefs, and therefore the chief ports are river ports.

Note the name of the port Recife (=reef).

On the other hand, Rio and Bahia can receive ships of all sizes, whilst Santos and Maceio have harbours for ships of 26 and 29 ft. draught respectively.

PRACTICAL EXERCISES

- (1) Compare the two rainfall tables shown below (a) as to the total amount of rain, (b) as to its monthly distribution. Show how the latter is in accord with the situation of the towns, the one in the selvas, the other in the campos. (Figs. 89-91.)

Rainfall of Manaos and Quixeramobim (inches).

		Manaos	Quixeramobim
Latitude		3° 8' S.	5° 16' S.
Longitude		60° 0 W.	39° 15 W.
Height		123 ft.	638 ft.
January		9.8	1.6
February		9.5	4.3
March		11.8	6.1
April		13.0	4.3
May		7.8	3.4
June		5.1	1.6
July		3.0	.9
August		1.8	.4
September		1.6	.08
October		3.9	.0
November		6.4	.04
December		10.3	.8
Total		<u>84.0</u>	<u>23.42</u>

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	Manaos	Quixeramobim
Av. annual temp.	80° F.	81° F.
Maximum monthly	80.6° F.	83.5° F.
Minimum monthly	78.0° F.	79.2° F.

(2) Study the following table:

	Para	Rio Grande do Sul
Latitude	1° 27' S.	32° 42' S.
Maximum monthly temperature	79.7° F.	73° F.
Minimum monthly temperature	77.0° F.	54° F.
Average	78.3° F.	63.5° F.
Total annual rainfall	86.8. in.	37.2 in.
Season	<i>least</i> Sept. to Nov. maximum Jan. to May	<i>mostly</i> July to August

A comparison of the above climatic details further illustrates the wide range of climates found in Brazil, as well as the characteristic differences between a warm temperate and a tropical climate. Which is which? Which has the highest average temperature, the greatest rainfall? the least range of temperature, and consequently the most evenly distributed rainfall? Which has the winter rains? Which has the maximum rainfall in the hottest season?

CHAPTER XXI

THE ARGENTINE

Study a map of Argentina. What are its extreme latitudes? Does any other country of South America extend over a greater range of latitude? Look at the isotherm maps (figs. 86-88) and observe the range of temperature between these extreme latitudes. What are its most easterly and westerly longitudes respectively? By which countries is Argentina bounded? Against which has it the longest boundary? Against which has it the most natural barrier? From which countries do the rivers Paraná, Uruguay, and Pilcomayo separate it?

What is the nature of the country as a whole? To what extent and in what parts is it (a) mountainous? (b) a low-lying plain? (c) a lofty plateau? (fig. 81).

Name its chief rivers. What large tributaries make up the basin of the Plate River? Trace the course of the Desaguadero and Salado. What becomes of these rivers? Account for the name Salado (salt). Note the positions of Mar Chiquita (Bitter Sea) and Salinas Grandes, two other depressions containing salt lakes and marshes.

THUS we see that, apart from its mountainous western boundary and its southern extension, Patagonia, which lies south of the Rio Negro, Argentina is a low-lying river basin, a vast depression between the ancient Brazilian tableland on the east and the more recent Andean upfold in the west. It is natural that this great and, as we shall see, exceedingly fertile plain with its wonderful navigable waterways, should be as yet the most developed and best known part of this extensive country—in fact the Argentine as it is known to commerce.

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From fig. 81 make a cross section of the country east and west through Rosario or La Paz.

Also diagrammatically show the elevation of the railway from Buenos Ayres to Mendoza from the following data:

Buenos Ayres, 65 ft. above sea-level.

Mercedes, 132 ft. above sea-level. 70 miles from Buenos Ayres.

Junin, 267 ft. above sea-level. 160 miles from Buenos Ayres.

Paunero, 400 ft. above sea-level. 1250 miles from Buenos Ayres.

What is the rate of elevation from Buenos Ayres (a) to Junin?

(b) to Paunero?

Geographically speaking, this great central territory falls into two main divisions, distinct from one another in structure, elevation, climate, and vegetation. The more northerly and more elevated section continuous with parts of Paraguay and Bolivia reaches as far south as lat. 27° and is known as the Gran Chaco, a name the derivation of which is somewhat doubtful. The southerly lower section sinks gradually from west to east and forms the well-known Pampas—a veritable sea of grass, at least knee-deep and stretching for miles in all directions, uninterrupted save by a very occasional tree or by a plantation.

This region, with its huge natural supplies of fodder, is the greatest cattle-raising region of the world. Since the first discovery of the possibilities of the Argentine as a great grazing land, many improvements have been made in methods of stock-raising. The original Spanish cattle have been replaced by the finest British stock, and large tracts of land are ploughed for the cultivation of lucerne (alfalfa). The mowing of this fodder is immediately followed by a crop of natural grass, and the cattle can by this alternation be assured of fresh green fodder all the year round.

The climate of this region, with a mean annual tempera-

ture of over 60° F., a complete absence of frost, and a moderate rainfall (fig. 105), is especially favourable to cattle-raising, inasmuch as the cattle can graze in the open all the year round.

Why is this better for the cattle? In what ways is it more economical for the stock-raiser?

Much of this stock-raising is done on a very large scale,

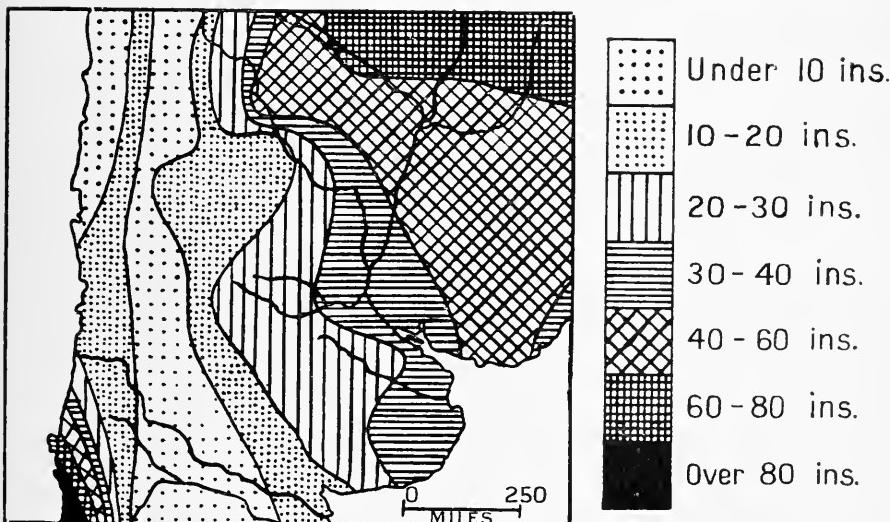


Fig. 105.—ARGENTINE RAINFALL.

Consider the lie of the land and the direction of the prevailing winds (figs. 3, 4 and 81), and explain the tendency of these rainfall regions to lie in belts roughly N. and S.

many farms belonging to wealthy stock-owners and such companies as Lemco, Oxo, and Bovril, with their cold stores and large establishments for the manufacture of the nowadays almost innumerable products of their trade.

Account for the hide and leather industries of the country. What necessity for this trade is provided by the Andean forests? (See p. 235.)

The Argentine plain is here and there dotted with depressions in its surface, which, if shallow, provide

excellent land for tillage, or if large and somewhat deep, form basins of inland drainage with either salt marshes or lakes.

Name from the map some inland lakes and rivers of inland drainage. What change in the climate of the country, would you think, has been operative in a low-lying land in cutting off the Desaguadero from its natural outlet into the sea (the Colorado) ? Suggest any possible causes for the drying of a climate.

The soil of the Pampas is mostly Loess and other quaternary deposits both diluvial and alluvial, and affords most excellent soil for cultivation. In this low-lying, remarkably well-watered plain irrigation can be readily applied if necessary and wheat, maize, and linseed are some of its chief products, not merely for home consumption but also for export.

For what is linseed used ? From what plant is it obtained ? What fibre is obtained from the same plant ? How does the Argentine stand among other countries of America in the production of wheat ? (see Table IVa).

What do you know of the formation of Loess ? By what agency is it supposed to have been deposited ?¹

Even at the present day the chief natural disadvantage of the Argentine is to be found in the frequent and violent southerly windstorms, known as Pamperos, to which it is subject almost all the year round, though they are at their worst in the spring and early summer.

Which months are these ? Suggest a reason for these southerly winds. Where is the barometric minimum likely to be established, over the sea ? over the mountains ? or over the plains ? When will the minimum most tend to be over Argentine ? Why is the Pampero a cold wind ?

As we travel northward to the Gran Chaco we pass

¹ See *Home of Man, Europe*, p. 79.

into a region altogether different in character from the Pampas of the lower Parana. In its northernmost parts it is almost to be regarded as a southern prolongation, though differing in character, of the great forest lands of the Amazon basin. Long stretches of sub-tropical forests are intersected by small, lower-lying, salty, pampas-like depressions or by larger and wider valleys which in the rainy season are partly under water and form a succession of lagoons several miles in length.

Note the latitude of these regions and account for the alternating wet and dry season instead of the smaller but comparatively evenly distributed rainfall of the Pampas.

These forests, as elsewhere, supply logwoods, dye woods and cabinet woods. Perhaps the most useful is the Quebracho,¹ the timber of which is very hard and useful (*e.g.* for railway sleepers), whilst its bark provides the necessary tannin for the leather industry.

Suggest how these materials can be brought down to Buenos Ayres.

Note, however, that many of these cabinet woods are too dense for successful flotation. How far is the Parana navigable? (See fig. 85.)

The southern border of the Gran Chaco is being more and more cleared for agriculture, and the climate and well-watered soil are both most suitable for sugar, cotton, and, tobacco.

One of the most fertile regions of Argentina is the district of Misiones which lies, as it were, tucked away between Paraguay and Brazil. With a warm and moist climate, a well-watered soil, and a river which is navigable along its western border, it has become one of the chief

¹ *Quebracho* means "break-axe"; it is a very hard wood with the appearance of red marble.

agricultural regions of the country, including amongst its products maize, sugar, tobacco, and fruits such as oranges, lemons, and pineapples. Its forests supply nuts and the widely used Yerba Maté or Paraguay tea.

The cordilleran territory of the Argentine is, comparatively speaking, little developed, but is in structure and character a geographical continuation of the corresponding parts of Peru, Bolivia, and Chile. The most fertile and therefore most thickly populated part of this region is the Puna de Jupiz. Other parts are, according to their climatic situation, alternately densely wooded, stony deserts, or salt marshy plains. According to the different character of the districts, the people are occupied in the production of potatoes, sugar, tobacco, or even wines, and in the herding of sheep, goats, and llamas.

*

Discuss the causes of these different regions. How are they affected by the lie of the land relative to wind, and to the outflow or evaporation of rivers? (See figs. 3, 4, 86 and 91.) Which of the above-mentioned products of these regions are grown (a) in the warm river valleys? (b) in the higher plains? In which parts does the grazing take place?

Silver, lead, copper, gold, and borax are among the minerals of this region, but the mines are at present but little developed.

Find Chilecito, the chief mining town, with silver and copper ores.

Coal and petroleum are both mined in small quantities near Mendoza, and lignite is found in several places. Fuel, however, has to be imported in considerable quantities.

The Andean regions are also liable to a peculiar north-westerly wind which blows down into the valleys and lower plains from over the western mountain chain. This

Zonda, as the wind is called, is, in spite of its having come over the snow-capped mountains, a warm, dry wind.

Explain this. How do you connect its character with the fact of its being a falling wind? What Swiss wind¹ and what wind of North America have a similar character and for a similar reason? (P. 54.)

Lastly, the district of Patagonia is much of it a stony steppeland and seems to consist of a series of raised sea beaches which may have been formed coincidentally with the elevation of the Andean chain.

Consider the natural winds of these latitudes, and the situation of the mountains, and explain the dryness of the country. Note the effect of the lower elevation of the mountains further south on the distribution of the rainfall of southern Patagonia. Why is it so much more widely distributed? (Figs. 3, 4, and 81.)

A moderate climate and irrigation render the land, especially in the river valleys, at the same time easy of cultivation and suitable for cattle and sheep raising, more particularly the latter, the bulk of the Argentine wool being produced in the regions to the south of Buenos Ayres. It may be recalled that, in dealing with the wool imports of Europe, we noted that France took most of the Argentine wool inasmuch as it required more cleaning than Australian wool and demanded special machinery.¹

Why was this taken up by French rather than by English manufacturers? Recall that Argentine wool came into the world's market far later than Australian and that the modern French wool manufacture, was later than the British. Look at the winter isotherm map (fig. 88) and note that cattle can winter in the open as far south as the river Chubut.

Note the positions of the following:

Resistencia (district) and Santiago del Estero, lumbering regions for both Quebracho and firewood. Why firewood? Suggest what will be the effect on the climate of the Argentine if the

¹ See *Home of Man, Europe*.

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Gran Chaco and the northern forest region are eventually deforested.

Rosario, Buenos Ayres, the capital, and Bahia Blanca—all great wheat ports, the two former exporting most of the linseed and Buenos Ayres most of the meat products.

Santa Elena—large stores and factories for hides and tallow. Colon—similar factories and a shipping port for these products.

Mendoza—a junction on the Trans-Andean railway to Valparaiso. Look at the contour map and discover approximately how high this railway rises.

Note that the farmers of the Argentine know before seed-time the character of the harvest of the countries of the northern hemisphere. Of what great value is this knowledge to them as regards the markets of the world ?

PRACTICAL EXERCISES AND QUESTIONS

(1) Compare Argentina and Brazil as regards area and density of population. Construct rectangles to the scales of 1 sq. mm.=1000 sq. miles and 1 sq. mm. shaded=50,000 people. Construct a rectangle on this scale to show the relative area of Peru. What other States of America have you compared together on this scale? (See Table I in the Appendix.)

(2) Compare these States as to their total trade, imports and exports. How do they rank among the States of the whole American continent and of South America respectively? Account for the different character of their exports. (See Table II.)

(3) With which countries of the world do these countries do most of their trade? Note that while the United States take by far the greater part of the exports of Brazil, a greater value of imports is derived from Great Britain. (See Tables IIIa and IIIb.)

Which country of Europe takes most of Argentine's wool?

(4) Why do oats form so large a portion of the cereal crops of the Argentine? (See Table IV.)

Seek the solution of this question by a comparison with table V.

(5) What is the most important crop of Brazil? How do Brazil and the Argentine compare in the production of sugar? (See Table IVb.)

(6) Compare Argentine with Brazil and Uruguay in the absolute amount of cattle and other domestic animals, and also in the amount per head of population. (See Table V.)

Explain this development of Argentina in reference to (a) the character of the country, and (b) its climate.

- (7) Compare Argentine with the United States and British North America as to the percentage of grazing land in the country. Show how Argentine is well placed in the event of a great industrial development in the country. It is stated that the United States have now to import meat. How do the figures of this table and of the previous one bear this out? (See Tables V and VI.)
- (8) To what extent are the Argentine and Brazil respectively mining countries? (See Table VII.)
- (9) How do these States compare with one another and with other American countries in shipping and in railway development? Explain the difference between the two countries in the extent of railway expansion. (See Tables VIII and IX.)
- (10) Compare the climates of the following towns, and note the great variations they indicate in the climate of the Argentine.

Name	Rosario	Mendoza	Santa Cruz
Latitude	32° 57' S.	32° 53' S.	50° 2' S.
Height above sea-level	94 ft.	2600 ft.	39 ft.
Maximum monthly temp.			
January	76.5° F.	74° F.	60.5° F.
Minimum monthly temp.	49° F. June	46° F. June	33° F. July
Average annual temp.	63° F.	60.5° F.	47° F.
Rainfall	36 in.	7.2 in.	6 in.

To what factor is the difference in rainfall as between Mendoza and Rosario due? To what the difference in temperature? What is the rate of fall of average annual temperature measured in degrees per 1000 ft. or in feet per degree? Which of these towns has a sub-tropical climate? Which a temperate climate? Why has Santa Cruz so different a climate from Rosario? Why has it a similar rainfall to Mendoza? (See figs. 3, 4, and 105.)

CHAPTER XXII

URUGUAY

Study carefully the position of Uruguay on the map of South America. Between what parallels of latitude and lines of longitude does it lie? What are its boundaries? Which are natural? By what States is it bounded? Compare roughly the length of its coastal with that of its river boundary. How does Uruguay compare with the other countries of South America as regards (a) area? (b) elevation? Name the chief rivers of this State. Roughly estimate the distance by river between Salto, the head of steam navigation on the Uruguay, to Montevideo, the capital and chief port.

WE thus see that Uruguay is the smallest State of South America. Geographically speaking, it may almost be regarded as a part of the Argentine republic, so similar are these two States in situation, structure, climate, and, therefore, products.

Recall the structure, climate, and products of the neighbouring part of the Argentine.

A glance at the map shows that the bulk of the country consists of alluvial coast land sloping away from the southern extensions of the Brazilian plateau, which in no part of the country exceeds 2000 ft. in height. (See fig. 81.)

The climate of this great stretch of alluvial land is most moderate, with an exceedingly small range between the winter and summer extremes, frost, at least on the lowlands, being quite unknown.

To what extent does the position of the country account for this?

Consider the latitude, the direction of the prevailing winds, and the relation to the ocean and large water boundaries. Compare carefully the figures in the table on page 242 with figs. 86-88.

Moreover, the rainfall is moderate and, as can be seen from the same table on the next page, very evenly distributed (figs. 89-91, and 105). When we add to these advantages of situation and climate the fact that the greater part of the soil is alluvial and very fertile, we are not surprised to find that the country is mainly agricultural and pastoral, but more particularly the latter.

Maize, wheat, and other cereals are now grown in more than sufficient quantities to supply the home demand, but most of the articles of export are derived from cattle-raising, the chief industry of the country. Lemco (Liebig Extract of Meat Co.) derive much of their supplies from the cattle-breeding regions of Salto, Rio Negro, and Paysandu, which latter has given its name to a well-known brand of tinned ox-tongues.

Study Tables II and V in the Appendix, and note the dependence of the exports upon this trade. Why is jerked beef exported to Brazil?

Sheep-grazing is also increasing in quantity and the wool, which is cleaner than that of the Argentine, fetches good prices.

Which regions are more suited for sheep and less suited for bullocks and oxen? Why? (see *Home of Man, British Isles.*) Connect the presence of good sheep-grazing land with the cleaner quality of the wool.

The valleys and lower hill slopes provide excellent timber of many kinds, as well as a number of medicinal plants, the black colour of the Rio Negro being even said to be due to sarsaparilla.

Geologically, as well as structurally, the country is a junction between the alluvial deposits of the Argentine valley and the southern limit of the Brazilian plateau, and in the hill regions there is probably considerable undeveloped mineral wealth of all kinds, including gold, manganese, silver, lead, and copper, none of which at present is exploited to any extent. Lignite coal also occurs in the same regions.

Why are these minerals found in the *northern* departments of the State?

Note the position of the capital, Montevideo, the chief city and port.

Can you suggest why in South America so many of the capitals are on the coast? How do the countries of the New World compare with those of the Old World in this respect?

Note also the position of Salto (the word means "a leap") at the head of navigation on the Uruguay, and of Mercedes, the principal port on the Rio Negro.

PRACTICAL EXERCISE

Climate of Montevideo

(Long. $34^{\circ} 54' S.$ Lat. $56^{\circ} 13' W.$)

	Average tem- perature, °F.	Rainfall in inches
January	71.8	3.3
February	71.1	2.4
March	68.6	3.5
April	63.1	3.4
May	59.7	4.0
June	52.5	3.4
July	50.7	3.4
August	50.7	2.7
September	58.8	3.1
October	63.3	3.8
November	65.1	3.0
December	70.0	3.2
Total		<u>39.2</u>

Represent these two on the same sheet of graph paper, marking the months horizontally and the rainfall and temperature vertically—the former by a dotted line and the latter by a thick line. Suitable scales: 1 cm. for each inch of rain, 1 mm. for each degree of temperature.

How does the rainfall compare with the changes of temperature? Does it increase with rise of temperature? How does this result compare in this respect with those obtained in the exercises on the tropical countries?

Compare these temperatures with the isotherm maps of South America (see figs. 86-88). Between which isotherms does Uruguay lie? Why is the maximum temperature in December and January? When is the minimum? What is the temperature difference? Suggest why this is so small. Would you call this a monsoon climate or a mild temperate summer and winter climate? How is the rainfall distributed? Is the maximum in summer or in winter? Look at the wind maps of the Atlantic (figs. 3 and 4) and determine from the distribution of the rainfall whether the winds of this country are part of the great ocean winds or are determined by mere local considerations.

CHAPTER XXIII

PARAGUAY

Make a careful map study of Paraguay. Describe its position. Between what latitudes and meridians does it lie? By what States is it bounded? In what respects does it resemble Bolivia? In what way has it the advantage of Bolivia in position? How far has Paraguay natural boundaries? Whence does this State derive its name? Name the chief rivers of the State. To what river basin do they belong? Look at fig. 85 showing the navigability of these rivers and determine their value to the State. What is the nature of the surface of the country (fig. 81)? Of what State of South America would you consider that Paraguay, geographically speaking, formed a part? To what extent and in which portion is it (a) flat, alluvial land? (b) hilly country?

THUS we see that Paraguay, like Bolivia, is entirely an inland State with, however, good river communication throughout its extent and with other countries.

Through what river basin and country does its export trade take place? In what respects does Bolivia as compared with Paraguay on this point stand (a) at an advantage? (b) at a disadvantage?

The country consists for the most part of comparatively low-lying land with a low hill-land to the north east of the Paraguay River and a low range of hills running through Paraguay proper, the country between the Paraguay and Parana Rivers. These low uplands, never more than 2500 feet in height, have a gentle slope to the west with broad valleys and navigable waterways, but to the east there is a much steeper fall and the rivers are interrupted

by rapids. These western uplands, the most settled districts of Paraguay, are, practically speaking, a northerly continuation of the grassy plains of the Argentine, but the eastern slopes are closely wooded, especially with the Yerba Maté tree, and form one of the chief regions of supply of the South American tea.

You are now in a position to explain why the Yerba Maté tea is called also Paraguay tea.

To the west of Paraguay the country is a part of the Gran Chaco, and is to the present day to a large extent unexplored.

Recall what you have learned of the character of the Gran Chaco.
Into which other State of South America does this region extend ?
(See pp. 234 and 235.)

In the forest regions are found large quantities of the Quebracho wood, to which reference has already been made (see p. 235).

The climate is sub-tropical with a very mild winter and a rainfall of about 40 inches, fairly well distributed throughout the year, though greatest in the spring.

Which are the coldest, warmest and wettest months of the year respectively ? (See table to question 7 on page 248.)

On the other hand, the rainfall is liable to rather great fluctuations from year to year, and especially of recent years. It has been showing a tendency to decrease.

Which is more liable to fluctuations of rainfall—a coastal or an inland country ? lofty highlands or enclosed lowlands ? What is the effect of deforestation ?

The amount of rainfall is, of course, partly dependent upon the character and direction of the prevailing winds.

The country is subject to extremes of wind, to cool, southerly winds which are dry and stimulating, and to moist northerly winds which are most relaxing.

Of which Argentine winds are the former a northerly continuation?

(See p. 234.) How do they originate? Why are they cool?

Considering the general character of the surface and the high average annual temperature, account for the salt marshes and lakes which are found in some of the depressions in the south of the State.

The land, most of which is quaternary and alluvial, has, geologically speaking, scarcely been examined, but it affords a fertile soil for agriculture. On the other hand, however, the mineral wealth is, at least at present, inconsiderable though the hills seem to be geologically a continuation of those in the Brazilian province of Rio Grande do Sul and to contain coal. Also copper, zinc, and iron would seem to be worth mining.

Thus we are prepared to find that the chief industries are, firstly, the preparation of Yerba Maté tea, and secondly ranching and the preparation of meat products, especially jerked beef for South American trade. Oranges are grown, practically without cultivation, but the fruit is not exported, being largely used for fattening pigs. Sugarcane and cotton are grown, and leather is made for home use, whilst pineapples, ramie thread, coffee, tobacco, timber of several kinds, and hides are exported.

Discuss the reason for the home leather industry. What is the nature of (a) the demand? (b) the supply of the necessary materials? Suggest a reason why, in connection with the live stock trade, the chief product should be the sun-dried jerked beef for the South American trade, whilst Uruguay and the Argentine hold most of the European trade. In answering this question consider the position of Paraguay and the nature of the storage and transport required for the frozen meat trade.

Discuss the positions and importance of the chief towns.

Asuncion—the capital.

Villa Rica.

Concepcion.

Villa del Pilar.

Encarnacion—large transit trade.

QUESTIONS AND EXERCISES ON PARAGUAY AND URUGUAY

- (1) Compare Paraguay and Uruguay as to area and density. Construct rectangles to the scale of 1 sq. mm. = 100 sq. miles and 1 sq. mm. shaded = 50,000 people. Which is the larger country? Which is the more densely populated? Suggest reasons for the latter. For what other countries have you constructed similar rectangles to the same scale? How do these countries compare with them, e.g. Great Britain, as to size and density of population? (See Table I in the Appendix.)
- (2) How do these countries compare with one another and with other countries in their trade as to its total value and nature, and as to the character of the chief exports and imports. What import is common to the two countries? Account for any difference you note in the chief exports. (See Table II.)
- (3) With which countries do these two States do most of their import and export trade respectively? (See Tables IIIa and IIIb.)
- (4) How does Uruguay compare with other States of America in the production of cereals? Which is its most productive cereal? (See Table IVa.)
What non-cereal product is cultivated in Paraguay? (See Table IVb.)
- (5) How do Paraguay and Uruguay compare with one another and with other American countries in the amount of live stock in the country (a) absolutely? (b) per head of population? (See Table V.)
To what extent do these statistics suggest from the economic point of view that Paraguay, Uruguay, and the Argentine form one geographical unit? How far is it structurally the case? What support to the view is given in Table VI?
- (6) Compare these countries with one another and with other American States in the extent of their railway development. To what extent are they supplied with other means of communication? (See Tables VIII and IX.)

(7) Study the following figures, showing the monthly temperature and rainfall of a settlement in Paraguay (Itacurubi, $24^{\circ} 27' S.$ and $57^{\circ} 2' W.$).

					Temperature, ° F.	Rainfall, inches
January .	.	.	.	.	80	8.8
February .	.	.	.	.	79	5.7
March .	.	.	.	.	77.4	5.0
April .	.	.	.	.	71.8	4.0
May .	.	.	.	.	65.7	3.7
June .	.	.	.	.	62.4	3.0
July .	.	.	.	.	64.6	3.1
August .	.	.	.	.	66.7	1.2
September .	.	.	.	.	68	2.3
October .	.	.	.	.	73	8.2
November .	.	.	.	.	76	5.9
December .	.	.	.	.	79.5	6.2
Average annual temp.	.	.	.	.	72.1	—
Total rainfall .	.	.	.	.		<u>57.1</u>

What do you conclude from the above figures as to the nature of the climate? Is it tropical or temperate? Continental or oceanic? What is the range of temperature? Are the rains winter rains or tropical summer rains? How does the range of temperature compare with that of Para? (See page 230.) Account for the difference.

CHAPTER XXIV

OUTLINE OF THE HISTORY OF SOUTH AMERICA

THE history of South America falls naturally into five divisions: (1) its history prior to its discovery by Spaniards and Portuguese; (2) the Conquest; (3) the period of Spanish and Portuguese rule; (4) the struggle for independence; and (5) the history of the Republics.

(1) As in North America, but little is known as to its early history owing to the absence of written memorials. The nations were split up into many warring tribes mostly savage and undeveloped, the chief exception being the Inca race of Peru, which had reached a remarkable stage of civilization, under the rule of monarchs of the most absolute type, whose rule, however, was on the whole beneficent and advantageous to their people. Their kingdom seems to date from about 1200 A.D. The Inca emperor claimed descent from the Sun, and the chief was worshipped and obeyed as a religious duty. The



Fig. 106.—A TYPICAL CUZCO INDIAN.

descendants and relations of the royal family formed a nobility in whose hands the whole government was placed, and the remainder of the people, together with the numerous races conquered by them were in a state of passive obedience to them. It was this fact which caused their conquest to be so easy, for the Spaniards had only to overthrow the Inca nobility and the country was then in their hands.

Our illustration, fig. 106, shows the gateway to a ruined temple built by some race even earlier than the Incas.

(2) The first landing in South America was made by Columbus on his third voyage; in 1500 a Portuguese under Calval discovered Brazil, and fourteen years later the mouth of the great river La Plate was first visited. But in the previous year the Spaniards under Balboa had crossed the Isthmus of Panama and had obtained the first sight of the Pacific, and it was by this route that the conquerors of South America made their way into the continent. The invasion of the Peruvian dominions of the Incas dates from 1532, and forms one of the most romantic episodes in all history. Never before or since were greater achievements accomplished by such tiny bodies of troops, and never did adventurers obtain such huge rewards in the form of enormous treasure. Much of this treasure was shipped to Spain, and its effects on the money markets of the world were so great that they can be traced throughout the history of the seventeenth and eighteenth centuries. The silver mines of Potosi are said to have doubled the world's store of silver at the time, and as silver was then the standard precious metal it is easy to see what serious effects such a discovery must have had upon prices and trade.

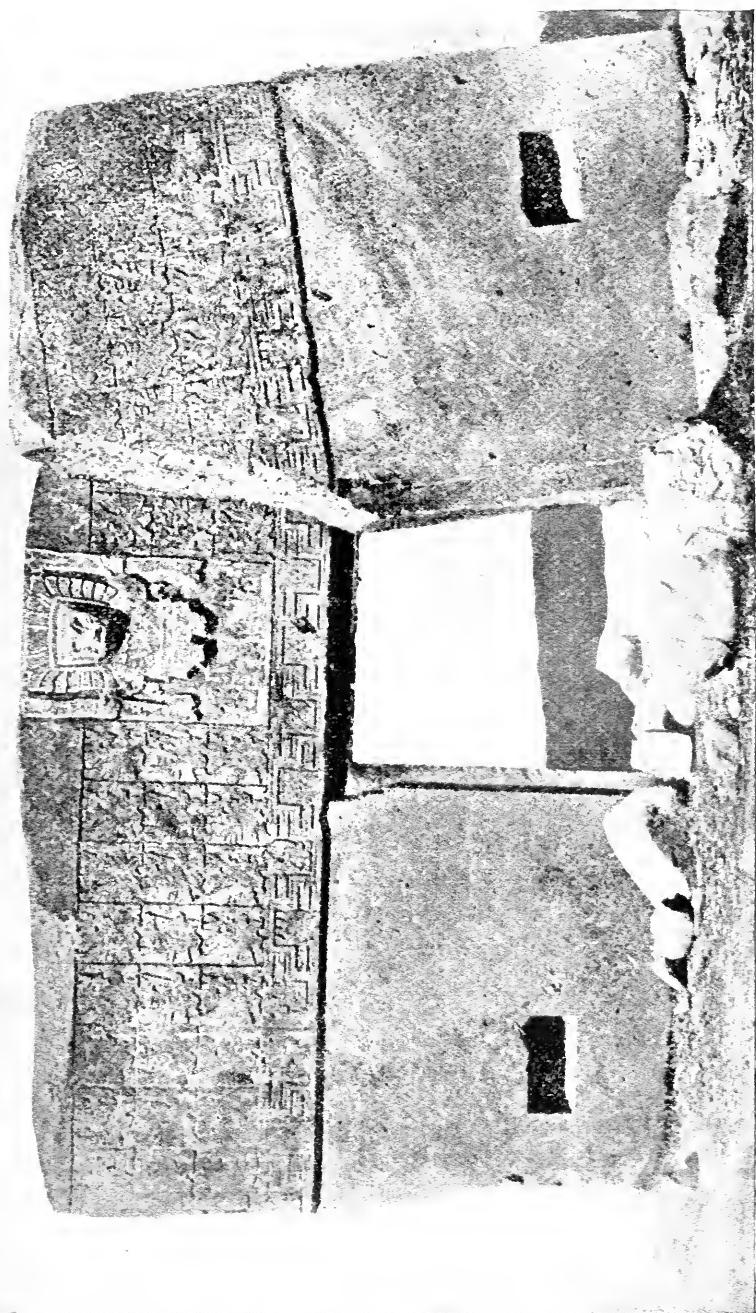


Fig. 107.—DOORWAY OF TIAHUANACO.
(Carved out of a single block of stone, $13\frac{1}{2}$ feet high and 7 feet wide.)
Tiahuanaco was situated on the plateau near the southern end of Lake Titicaca, 13,000 feet above sea level.

(3) The success of the Spaniards naturally caused great jealousy among other nations and to this fact must be attributed many of the stories of barbarity, ill-treatment, and massacre which have come down from those times. The conquest of native races must always be attended with many distressing circumstances, and it is doubtful whether the Spanish were much worse than other nations in their treatment of the natives. There is, however, no doubt that they were injudicious, if success is to be measured by its permanent results, for while Spain claimed the whole continent for herself, with the exception of Portugal's share, and successfully maintained that claim for three centuries, yet the last century has seen the whole of her great American dominions wrested from her piece by piece till now there is not a particle left.

One important distinction between the policies of Great Britain and Spain with regard to the natives has left an indelible mark upon the population of South America, namely, the extraordinary extent to which whites, natives, and blacks have mingled so as to form a race of mixed parentage. The Spaniards, in fact, seem to know nothing of the Anglo-Saxon insuperable dislike for and contempt of any infusion of "coloured blood." The broadness of the Roman Catholic Church with its readiness to admit all and any into its fold, added to, or perhaps caused, this point of view so different from the British. Two important results followed from this mixture of native with white man; firstly, the building up of a new race, who looked upon America as their home and who gradually lost any appreciation of Spain as a mother country, and secondly, a feeling of antagonism on the part of this race toward the officials sent from

Spain to rule them, for nearly all such positions were placed in the hands of envoys from Europe.

(4) That such a race should ultimately struggle for its independence was inevitable, that the struggle was premature is equally certain ; but it is only a careful enquiry into the contemporary history of Europe that will explain the causes of this struggle—too early commenced and in many respects too feebly attempted. The leaders were mostly fighting for themselves alone, the people were quite unsuited for self-government, the result was a succession of so-called dictators who ruled despotically until a stronger opponent ousted them from their position, while the population watched with more or less apathy the constantly repeated drama.

(5) It was Napoleon's conquest of Spain, his deposition of the Spanish monarchs and substitution of his brother Jerome that freed many of the colonies from their allegiance. Their revolution was rendered the easier by Great Britain's mastery of the sea and destruction of the Spanish fleet at Trafalgar. Revolution had proceeded far when peace was declared, and Spain never regained her power. Meanwhile South America became the happy hunting ground of military adventurers of all nations, though it is only fair to state that some of the leaders, and these the most successful, were urged on by a genuine love of Liberty—such were José San Martin, the liberator of Chili and Peru, and General O'Higgins, one of his officers, who became president of Chili. By 1820, however, all South America, except French, British, and Dutch Guiana, had proclaimed its independence of European control, and since then the ten countries into which it is divided have been working out their own destiny, with varying success.

The twentieth century, however, finds them in a remarkably prosperous condition and the steady influx of immigrants and of capital from the Old World seems to foretell for them a future of tremendous promise;) for while South America is at present the most sparsely inhabited of all the continents, it is yet the richest in natural products. The mighty forests of the Amazon and other tropical rivers are full of valuable timbers, rubber, vines and many another precious form of vegetation, while it is safe to assume that amid their wide-stretching, unknown and unexplored regions there lies hidden many a secret to be laid bare by the onward march of science. The obstacles to their development are many, but they are by no means insuperable, as is shown by the wonderful achievements of the United States in the similar, though smaller, region of the Panama Canal. South America has, in fact, herself provided the means of overcoming the worst of these obstacles, for it is in the forests of Brazil that the cinchona tree was first discovered, from which quinine, the wonderful remedy for the deadly tropical fevers, is prepared. The splendid work of the various Schools of Tropical Disease will doubtless in time find similar remedies for the other malignant diseases that threaten the traveller in these regions and the tropics will thus no longer be known as the "White Man's Grave."

When once the climate has been conquered, the other obstacles should prove comparatively easy of removal, for it must be remembered that South America offers a system of inland waterways unequalled in any other part of the world. Steamers can ply without hindrance over thousands of miles of splendid rivers; unobstructed by falls or rapids, and communicating one with another by more or less navigable natural canals. (See fig. 85, p. 169.)

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The chief obstacles to the development of agriculture are that nature is too generous, the soil too rich, the sun and rain too abundant. Such obstacles, however, can surely be overcome by skill and perseverance. Much wealth must be invested in the form of labour and clearing, but the returns will then be rapid and great, and the course of time may yet see tropical South America taking her place as the granary of Europe and the civilised world, just as temperate South America is already on the way to becoming the great home of the cattle and sheep that supply the foreign meat markets of the world. But the necessary wealth has not been forthcoming in the past, owing partly to the poverty of Spain and of Portugal, to whom the development must in the past have been due, and in modern times to the insecurity of the various governments of the republics. There is now, however, every sign of the advent of more security for merchants and engineers, and large sums are being invested in the carrying out of great enterprises so that we may soon see the Amazons and La Plata, at least, as well supplied with lines of steamers as the more difficult and less productive rivers of Africa, where, owing to the enterprise of Great Britain, Germany and France, the development in the last few years has been so rapid.

REVISION QUESTIONS ON CENTRAL AND SOUTH AMERICA

By kind permission of the University of Cambridge Local Examinations syndicate the following questions have been taken from Senior examination papers and can be well answered by students who have worked *conscientiously* through the preceding chapters.

- (1) In what way is commerce helped or hindered by natural peculiarities in South America? Illustrate each statement you make by reference to some country.
- (2) From what parts of Central or South America does Great

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Britain import (a) mahogany, (b) nitrates, (c) rubber, (d) sugar, (e) wheat?

- (3) How does the west coast of South America south of latitude 40° S. differ from that further north?
In answering this question consider structure, regions of elevation, regions of depression, and climate.
- (4) Draw two outline maps of South America and in both mark the position of the Equator and the tropic of Capricorn. In one of these maps indicate broadly the distribution of the annual rainfall, and in the other the distribution of forest, grassland, and desert.
- (5) State carefully the positions of the following towns: Rio de Janeiro, Iquique, Monte Video, Belize, Panama, Quito, Manaos, Pernambuco, Caracas, Lima, Valparaiso. Explain as far as you can the special importance of each by reference to its position.
- (6) Draw a sketch map showing the boundaries of the countries of South America. Point out how far these boundaries are formed by physical features.
- (7) Give an account of the vegetation, distribution, and economic importance of tropical forests in South America.
- (8) Describe the desert regions of South America and account for their positions. Name any articles of commerce obtained from them.
- (9) Describe the positions and character of the Llanos, the Selvas, the Pampas, the Falkland Isles, and Lake Titicaca.
- (10) Draw a map of the Plate River basin. Indicate the States into which it is divided and the positions of the chief towns.

APPENDICES

TABLE I
AREA AND POPULATION

Country.	Land Area 1,000 sq. miles.	Total Popu- lation. Millions.	Density per sq. mi.
A. United Kingdom . . .	121.4	45.4	374
Lancashire . . .	2.0	4.4	218.1
Lincoln . . .	2.6	0.5	161
1. United States . . .	2973.9	92.0	30.9
New York State . . .	47.7	9.1	191.2
South Carolina . . .	30.5	1.5	49.7
Nebraska . . .	76.8	1.2	15.5
2. British North America . .	3767.1 (Water area = 126.0)	7.4	2.0
Quebec . . .	351.9	2.0	5.7
Ontario . . .	260.9	2.5	9.7
Saskatchewan . . .	251.7	0.5	2.0
Manitoba . . .	73.7	0.5	6.2
Alberta . . .	254.9	0.4	1.5
British Columbia . . .	360.1	0.4	1.1
N.-W. Territories . . .	1207.9	0.02	0.01
Yukon . . .	206.4	0.009	0.04
Prince Edward's Island . . .	2.2	0.09	42.9
New Brunswick . . .	27.9	0.4	12.6
Nova Scotia ; . . .	21.4	0.5	23.0
Newfoundland } . . .	162.7	0.2	1.5
Labrador . . .			

APPENDICES

TABLE I—*continued*
AREA AND POPULATION

Country.	Land Area. 1,000 sq. miles.	Total Popu- lation. Millions.	Density per sq. ml.
3. Mexico . . .	767.0	15.1	19.6
4. Guatemala . . .	48.3	2.0	41.3
5. Belize (Br. Honduras) .	8.6	0.04	4.7
6. Honduras . . .	46.3	0.6	12.0
7. Nicaragua . . .	49.2	0.6	12.2
8. Costa Rica . . .	23.0	0.4	16.9
9. Panama . . .	32.4	0.4	13.2
10. Colombia . . .	461.6	5.5	11.8
11. Venezuela . . .	394.0	1.3	3.2
13. British Guiana . . .	90.3	0.3	3.3
14. French Guiana . . .	30.5	0.05	1.6
15. Dutch Guiana . . .	46.1	0.09	1.9
12. Ecuador . . .	116.0	1.5	12.9
16. Peru . . .	695.7	4.5	6.5
17. Brazil . . .	3292.7	21.5	6.5
18. Bolivia . . .	708.2	2.3	3.4
19. Chili . . .	292.6	3.4	11.1
20. Argentine . . .	1153.1	7.2	6.2
21. Paraguay . . .	171.8	0.7	4.1
22. Uruguay . . .	72.2	1.2	16.3
23. West Indies . . .	100.0	6.5	65.0

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TABLE II
EXPORTS AND IMPORTS—£1,000,000

Country.	Value of Im- ports.	Value of Chief Imports.	Value of Ex- ports.	Value of Chief Exports.	
A. United Kingdom	744.9	Foodstuffs Cotton (Raw)	218.8 80.3	599.6	Cotton manu- factures Iron and Steel Coal
B. France . . .	392.4	Cereals Wool Raw Cotton	28.6 25.1 22.0	320.5	Textile and articles of Apparel
C. Germany . . .	506.0	Raw Cotton Barley Wheat	30.2 23.1 19.9	437.0	Iron Goods Cottons Coal
3. Mexico . . .	14.3	Mineral Vegetable Machinery	4.7 3.1 2.3	29.8	Silver Gold Copper and ore
4. Guatemala . . .	1.3	Cottons Ironware, machinery and coal Woollens . . . . .	.4 .1 .05	2.2	Coffee Bananas Sugar
5. Belize . . .	.6	Chile (Supodilla Gum) Mahogany . . . . .	.1 .1	.5	Gum (chewing) Mahogany
6. Honduras . . .	.6	Cottons . . . . .	.2	.6	Bananas Minerals
7. Nicaragua . . .	.5	Textiles . . . . .	.1	.7	Coffee Gold
8. Costa Rica . . .	1.8	Cotton goods . . . . .	.2	1.8	Bananas Coffee Gold and silver
9. Panama . . .	1.8	Cotton2	.4	Bananas
20. Paraguay . . .	1.3	Textiles Foodstuffs3 .3	1.0	Hides Tobacco Timber

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TABLE II—*continued*
EXPORTS AND IMPORTS—£1,000,000

Country.	Value of Im- ports.	Value of Chief Imports.	Value of Ex- ports.	Value of Chief Exports.
15. Peru . .	6.4	Manufactures of Iron and Steel	7.4	Minerals . . 2.0 Sugar . . 1.0 Coffee . . 1.0 Coffee . . 2.2 Cocoa . . . Balata and Rubber . . 6.0
11. Venezuela . .	3.8	Cotton goods and thread	4.6	Tin . . 3.0 Silver . . 2.0 Rubber . . 2.2
17. Bolivia . .	4.7	Manufactures of Iron . . 2.2 Cotton Cloths . . 1 Sugar . . 1	6.6	Coffee . . 46.5 Rubber . . 16.1 Leather . . 2.0
16. Brazil . .	63.4	Cotton manufactures . . 2.4	74.6	Frozen Meats and Skins 31.0 Maize . . 21.8 Wheat . . 19.0 Minerals . . 22.0
19. Argentine . .	76.2	Textiles . . 15.7 Iron . . 9.2 Pottery . . 6.7	95.1	
18. Chili . .	26.2	Cottons and Woollens 5.9 Coal and other Minerals 5.1 Oil, etc. . . 3.9	25.5	
10. Columbia . .	3.6	Coal . . 4.5	..	Coffee . . 1.0 Bananas . . . Gold . . . Diamonds . . .
12. British Guiana . .	1.8	Fabrics . . .3 Flour . . .2 Coal . . .03	2.2	
13. French Guiana . .	.5		.5	Gold Ore . . . Gold . . .
14. Dutch Guiana . .	.6		.7	
21. Uruguay . .	10.5	Cottons . . .9 Iron and Steel . . .6 Coal . . .4	10.9	Wool . . 3.0 Hides . . 2.0 Meat and Extracts 1.0
1. United States . .	330.6	Coffee . . 23.6 Sugar . . 23.1 Hides and Skins . . 20.5	440.8	Cotton (unmanufactured) 103.
2. British N. America . .	111.8	Iron and Steel manufactures 17.2 Coal and Coke 6.4	63.1	Wheat . . 12. Manufactures of Wood . . 8.

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TABLE IIIa

IMPORTS—£1,000,000

To	From				
	U.K.	U.S.A.	B.N.A.	Germany.	France.
A. United Kingdom	134.6	26.9	70	49.5
I. United States	. . 118	..	23.9	32.4	26.4
3. Mexico	. . .	2.3	9.8	.25	2.4
9. Panama4	1.0	.06	.2
11. Venezuela	. . .	1.1	1.1	.007	.7
15. Peru	. . .	1.7	1.2	.007	.9
16. Brazil	. . .	12.6	7.1	.2	8.9
18. Chili	. . .	6.6	3.2	.05	6.7
19. Argentine	. . .	21.5	10.4	.6	13.1
21. Uruguay	. . .	2.9	.87	.015	1.3
2. British North America	. 22.1	38.3	..	2.0	2.3
4. Guatemala1	.4	..	.25
5. Belize1	.3	..	.01
6. Honduras1	.4	.03	.05
7. Nicaragua1	.3	..	.1
8. Costa Rica3	.7	..	.2
10. Colombia	. . .	1.1	.8	..	.45
17. Bolivia	. . .	1.0	.8	..	.8
20. Paraguay4	.1	..	.4

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TABLE IIIb

EXPORTS—£1,000,000

From	To				
	U.K.	U.S.A.	B.N.A.	Germany.	France.
A. United Kingdom	30.1	23.5	40.4	25.6	
1. United States . . 59.2	..	58.3	48.5	25.3	
3. Mexico . . . 4.0	22.4	1.0	1.0	.8	
9. Panama04	..	..	..	..
11. Venezuela7	1.5	.02	.9	1.3	
15. Peru . . . 2.4	2.0	.03	.6	.4	
16. Brazil . . . 9.4	23.1	.2	9.4	5.1	
18. Chili . . . 10.9	4.0	.08	5.4	1.2	
19. Argentine . . . 18.2	4.8	.5	8.5	7.9	
21. Uruguay28	.3	.001	1.3	1.9	
2. British N. America . 27.4	23.9	..	.5	.5	
4. Guatemala3	.5	..	..	..
5. Belize1	.4	..	..	.005	
6. Honduras001	.6	..	.025	.004	
7. Nicaragua16	.3	..	.2	.2	
8. Costa Rica . . . 1.2	1.0	..	.1	.01	
10. Colombia . . . 1.0	1.8	..	.8	.2	
17. Bolivia . . . 4.8	.05	..	.9	.5	
20. Paraguay0002	.001	..	.2	.01	

TABLE—IVa

AGRICULTURAL PRODUCTS : A—CEREALS

Country.	Wheat.		Barley.		Oats.		Rye.		Maize.		Rice.		Linseed.	
	Million Acres.	Million Bushels.	Million Acres.	Million Bushels.	Million Acres.	Million Bushels.	Million Acres.	Million Bushels.	Million Acres.	Million Bushels.	Million Acres.	Million Bushels.	Million Acres.	Million Bushels.
A. United Kingdom	2.0	57.4	1.8	58.2	4.1	164.8	4.3	..	..	..	..	..	..	..
1. United States	45.8	730.3	7.5	223.8	37.9	1418.3	2.1	35.7	107.0	3124.8	.7	25.1	..	..
	North Dakota	143.8	..	..	..	..	..	..	Illinois	343.7	Louis.	11.8	..	..
2. Br. N. America	11.3	216.9	1.9	54.0	9.6	367.5	.2	2.7	.3	15.5	..	..	..	..
	Chief Provinces	Sask.	96.7	Manitoba	24.0	Sask.	98.6	..	..	..	..	..	..	..
18. Chili	2.3	9.9	.1	1.1	.1	.5	.003	.05	.05	1.2	..	..	.0003	.005
19. Argentine	15.0	152.0	.1	2.5	2.0	336.4	.04	..	7.3	180.0	.01	..	3.8	1.0
4. Guatemala	..	.5	..	.02	..	.1	..	..	..	6.0	..	.1	..	..
6. Honduras	..	.05	..	..	..	..	..	..	..	.4	..	.04	..	..
15. Peru	..	.2	5.5	.2	5.3	..	..	..	.1	5.9	.1	1.2	..	..
21. Uruguay	..	.8	9.4	.01	.1	1.0	..	..	.6	3.8	..	..	..	.5
3. Mexico	..	1.7	11.5	1.4	6.4	..	..	..	14.7	185.0	.2	3.6	..	..

TABLE IVb
AGRICULTURAL PRODUCTS : B—OTHER THAN CEREALS

Country.	Flax.		Cotton.		Tobacco.		Sugar.		Coffee.		Rubber.	
	Million Acres.	Million lbs.	Million Acres.	Million lbs.	Million Acres.	Million lbs.						
A. United Kingdom	.05											
1. United States	.2.8	1080.8	36.0	8150.0	1.2	..	.5	1650.0 ¹	..	..	..	..
Chief States	..	..	Texas	4.4	Kentucky	394.0	..	..	..	..	..	..
2. British North America	1.3	722.4	..	..	..	..	..	448.0	..	..	..	..
Chief Provinces	Alberta	593.6	..	..	..	..	..	Ont. [?]
3. Mexico	..	.005	.2	85.5	.02	31.5	..	352.6	..	77.8	..	..
19. Argentine	..	4.07	..	9.6	.002	.23	..	224.0	.003	..	..	..
4. Guatemala	..	..	..	..	1.3	..	..	16.6	.88	78.5	..	.6
6. Honduras	..	..	..	..	.004	1.7	..	..	.4	.004	.7	..
7. Nicaragua	..	..	..	..	..	..	..	8.9	.3	26.4	..	..
10. Colombia	..	..	..	..	..	..	.01	687.9	..	..	..	..
17. Bolivia	..	..	..	..	..	..	..	..	..	..	40.6	..
16. Brazil	..	..	..	150.0	..	..	..	..	..	1651.2	..	64.7
20. Paraguay	..	..	..	..	..	14.3	..	..	..	..	..	..
15. Peru	..	..	..	30.0	..	2.2	.2	224.0	..	..	..	..
11. Venezuela	..	..	..	..	..	6.7	..	..	6.7	.2	..	..
8. Costa Rica	..	..	..	..	..	..	..	..	..	4.5	.07	..
12. British Guiana	..	..	..	..	..	..	.07	..	..	.003	..	..
14. Dutch Guiana	22.4

¹ Cane Sugar 682.0 million lbs. Beet Sugar 968.0 million lbs.

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TABLE V
AMOUNT OF LIVE STOCK—MILLIONS

Country.	Cattle.	Sheep.	Goats.	Swine.	Horses, Mules, and Asses.	No. of Food Animals per head of Popu- lation.	No. of Trans- port Animals per head of Popu- lation.
A. United Kingdom	11.7	31.3	..	4.0	2.5	1.0	.06
1. United States .	58.0	52.4	2.9	6.4	25.0	1.9	.3
2. Brit. N. America	6.9	2.4	..	2.7	2.5	1.6	.3
19. Argentine . .	29.1	67.2	3.9	1.4	8.5	12.7	1.2
3. Mexico . .	5.1	3.4	4.2	.6	1.5	.9	.1
18. Chili . .	1.6	3.5	.1	.2	1.0	1.6	.1
16. Brazil . .	3.7	.1	..	1.2	.4	.2	.01
21. Uruguay . .	8.2	26.3	.04	.2	.7	29.0	.6
20. Paraguay . .	3.0	.2	.03	.02	.2	4.8	.3
11. Venezuela . .	2.0	.2	1.7	1.6	.6	4.3	.45
17. Bolivia . .	.7	2.1	.5	.1	.2	1.5	.1
4. Guatemala . .	.2	.1	..	.03	.1	.15	.05
6. Honduras . .	.5	.02	..	.1	.1	1.0	.2
7. Nicaragua . .	1.2	.004	..	.01	.01	2.0	.02
8. Costa Rica . .	.3	.001	..	.1	.1	1.0	.25
9. Panama . .	.1	..	.003	.03	.02	.25	.05
12. British Guiana . .	.1	.02	.01	.02	.003	.5	.1
B. France . .	14.5	16.4	1.4	6.7	3.8	1.0	.1

TABLE VI
USES OF THE LAND

Country.	Percentage of Total Area.			Area of Foodland per head of popula- tion.	
	Foodland.		Forest.		
	Under Crops.	Grazing.			
A. United Kingdom . . .	12.9	65.8	3.9	1.3	
B. France . . .	56.3	10.5	15.8	2.2	
C. Germany . . .	48.8	16.0	25.9	1.3	
E. Russia . . .	26.2	15.9	38.8	4.2	
I. United States . . .	25.1	6.8	28.9	6.6	
2. British North America	1.5 ¹	5.0 ¹	25.8 ¹	20.8	
3. Mexico . . .	6.1	24.6	9.0	10.0	
4. Guatemala . . .	..	2.5	4.2	..
21. Uruguay . . .	3.0	80.0	..	21.6	
17. Bolivia . . .	1.1	..	..	..
13. French Guiana . .	.009	..	..	..
12. British Guiana . .	.25	..	..	..
19. Argentine . . .	6.7	54.3	14.6	63.0	

¹ Roughly estimated.

TABLE VII
MINERALS AND MINING

Country.	Coal.	Oil.	Gas Gases	Gold.	Silver.	Precious Stones,	Iron. Pig. Steel.	Copper.	Lead.	Zinc.	Among other Minerals.
	Bi.	Anth.	Thousands of Metric Tons.	Value Million	Thou- sands Troy Ozs.	Value £	Million Tons.	Million Tons.	Million Tons.	Million Tons.	
A. United Kingdom	20	7.5	..	..	1.2	142.1	..	9.0	5.4	.03	..
1. United States	405.8	80.8	35,787.2	74.1	4,687.1	60,399.4	68,738 ¹	23.3	..	.4	.2 Nickel .09 mill. lbs.
2. Brit. N. America	11.3	49.6	1.8	493.7	32,740.7	..	.9	.8	.03	.003 Nickel 34.1 mill. lbs. Asbestos .1 mill. tons.	..
3. Mexico	..	.01	2,646.0	..	45.8	73,942.0	..	..	.2	.1	..
10. Colombia	..	..	..	..	154.0	431.0	200,000 ²	..	..	.04	..
16. Brazil	..	.015	..	..	109.0	..	..	..	..	..	..
18. Chili	..	1.0	..	..	.05	1.7	..	..	..	..	Nitrates 1.4 mill. tons.
15. Peru	..	.08	70.8	..	.04	9,566.0	..	..	.02	.002	..
13. French Guiana	..	..	..	..	.1	..	..	..	..	..	..
12. British Guiana	..	..	..	..	.1	..	..	..	..	..	..
19. Argentine	..	..	..	..	.01	.4	..	..	.002	.05	.04 ..

¹ Turquoise, Montana, £43,062.

² Emeralds only.

TABLE VIII

SHIPPING

Owned By							Million Tons	Tonnage
A. United Kingdom	.	.	.	.	.	.	18.4	
1. United States	.	.	.	.	.	.	7.7	
C. Germany	.	.	.	.	.	.	3.0	
D. British Colonies	.	.	.	.	.	.	1.5 ¹	
B. France	.	.	.	.	.	.	1.4	
19. Argentine	.	.	.	.	.	.	.2	
16. Brazil	.	.	.	.	.	.	.2	
18. Chili	.	.	.	.	.	.	.1	

¹ This figure includes .91 million tons tonnage of British North America.

TABLE IX

COMMUNICATIONS

Country.		Miles of Railroad.	Miles of Railroad per 100 sq. miles.
A. United Kingdom	.	23,500	19.4
B. France	.	30,000	14.5
C. Germany	.	40,000	19.2
1. United States	.	246,573	8.3
2. British North America		25,400	.7
4. Guatemala	.	433	.9
3. Mexico	.	17,000	.2
6. Honduras	.	100	.2
7. Nicaragua	.	200	.4
8. Costa Rica	.	459	2.0
9. Panama	.	471	1.4
10. Columbia	.	621	.1
11. Venezuela	.	538	.1
12. British Guiana	.	95	.1
15. Peru	.	1,656	.2
16. Brazil	.	19,200	.6
17. Bolivia	.	778	.1
18. Chili	.	5,952	2.0
19. Argentine	.	20,000	1.7
21. Uruguay	.	1,570	2.2
20. Paraguay	.	232	.1

The following tables give particulars of the growth, use, and distribution of some of the more important vegetable products.

TABLE X
FOODSTUFFS : A—CEREALS

	Climatic Conditions.	Soil.	Average Yield per Acre, Bushels.	Chief Regions of Production.	Uses and Preparation.
Rice .	Heavy rainfall ; high summer temperature about 80° F.	Low-lying land enriched by alluvial deposits, less important <i>hill rice</i> up to 8000 ft.	S.E. of United States, Japan, India, Siam, N. Italy.	Common article of food especially in tropical countries.	
Millet	Warm summer ; no frost.	Rich, but friable.	90	Egypt, China, Southern Europe, South. United States, India, N. Africa.	Common article of food in tropical countries ; cheaper than rice ; as groats, with wheat-flour in bread, feeding poultry, green fodder.
Wheat	Cool, moist spring, hot dry summer, winter not too cold; average 66° F.	Soil chiefly clay, but not too heavy.	18	Canada, U.S.A., Argentine, Russia, India, Australia.	Macaroni ; chief cereal in temperate regions.
Barley	As wheat, but somewhat harder.	Light, open, preferably calcareous.	36	British Isles, Central Europe, Mediterranean region, United States.	Brewing ; sheep-feeding.
Oats .	As wheat, but also moister and cooler.	Almost anywhere.	40-80	N. Europe, Canada, New Zealand.	Porridge, etc.
Rye .	Colder than wheat.	Satisfied with poor soil and inhospitable climate.	25-30	Central European Plain.	Black bread, straw for hats, paper, and forage.
Maize (Indian Corn)	Warm, with medium rainfall ; long hot days and warm nights.	Deep, light, warm, rich, dry, mellow (<i>c.f.</i> Mississippi).	36	Central United States, Brazil, Argentine, New South Wales and Queensland, China, S. Europe, S. Africa.	“Boston” brown bread,” corn-flour, corn starch, corn syrup.

TABLE X—*continued*FOODSTUFFS (*continued*): B—OTHER THAN CEREALS (i)

Climatic Conditions.	Soil.	Chief Regions of Production.	Remarks.
Sago . . Tropical heat.	Moist.	Moluccas, Philippines, New Guinea, Borneo.	Derived from pith of a palm.
Tapioca . . Tropical heat and moisture.	Moist and fairly rich.	W. Indies, tropical South America, South Islands.	Derived from roots of cassava plant.
Arrowroot . . As tapioca.	Moist.	W. Indies, Brazil, tropical S. America.	Obtained from the rhizomes of the arrowroot plant.
FRUITS (ii)			
Apples . . Temperate, <i>best</i> under warm sunny climate.	Well-drained, mellow, calcareous loam.	Central Europe, North America : Great Lakes District, Ohio, Penn., Delaware, California, British Columbia, Australia, Tasmania, and New Zealand, S. Africa.	
Oranges . . Hot temperature, sunny climate.	Moist, but well-drained stiff loam or calcareous marl.	Mediterranean, Spain, China, Japan, Australia.	

TABLE X—*continued*FOODSTUFFS (*continued*): FRUITS (ii)

	Climatic Conditions.	Soil.	Chief Regions of Production.	Remarks.
Lemons .	“Mediterranean” climate, moist and sunny, warmer than for oranges; about 62° F. 70°-80° F.	Rich, turfey loam, somewhat heavy.	S. Europe—Spain, Italy, Sicily. California, Florida.	
Melons .	Very hot 68°-69° F. (less than 64° foliage only).	Dry, with moist subsoil.	Sicily, parts of Italy, parts of France (Paris). Canary Islands, N. Africa, S.E. Asia, India.	
Dates .	Long warm summer, no frost. 63°-70°. Will not fruit above 70°.	Well-drained, warm soil, not too rich.	Europe—Spain, France, Rhine slopes, Italy. Cape Colony, S. Australia, California.	
Grapes .	Cool temperate (hardy).	Good, well-drained, loamy soil of medium quality, preferable.	Europe—England, Bosnia, Serbia, Spain, Portugal S. France, Caucasus, Armenia, California, Australia.	<i>Raisins</i> = sun-dried grapes. <i>Prunes</i> = sun-dried plums.
Plums .	Cool temperate, warm situation.	Deep, substantial, well-drained, calcareous loam.	Europe—United States, California, New York, Michigan, Texas.	
Pears .				

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TABLE X—*continued*
 FOODSTUFFS (*continued*): B—OTHER THAN CEREALS (iii)
Beverages, Drugs, etc.

	Plant.	Part of Plant.	Conditions of Growth.	Chief Regions.	Remarks.
Tea . .	Tea bush.	Leaf.	Still, steamy heat. Drained soil.	China, Japan, India, Ceylon, Java, Formosa. Shan States, Natal.	
Coffee .	Coffee shrub.	Seeds (?) in each berry.	Flourishes on volcanic soil.	Brazil, Java, Venezuela, Haiti.	
Cocoa .	Cacao tree.	Seeds.	Thoroughly tropical climate. Temp. 80° F. Rainf. 50-100 in.	S. America— Ecuador, Venezuela, Brazil, Honduras, Mexico, Ceylon, Java.	
Yerba maté	Ilex tree.	Leaves (infused).	Sub-tropical.	Paraguay, Argentina, Brazil.	
Tobacco .	Nicotiana.	Leaf.	<i>Best</i> —tropical or semi-tropical, comparatively dry, sheltered from winds, sunny.	Eastern U.S.A., Jamaica, Cuba, Mexico, India, China, Turkey in Europe, etc.	

TABLE XI

VEGETABLE FIBRES

Plant.	Part of Plant.	Climatic Conditions.	Chief Regions.	Remarks.
Cotton . .	Cotton plant, allied to holly-hock.	Covering of seed.	Warm or hot, (60° F.) moist, but not wet.	South and East U.S.A., India, Egypt, Russia, China, Brazil, Mexico.
Flax . .	Flax plant (linum), hence name linen.	Fibres in stem.	Widerange. Cool, for fibre.	Russia, Belgium, Linseed oil, oil cake, etc. N. Ireland. (India, U.S.A. for oil only).
Jute . .	Jute plant (chorus).	Fibres in stem.	Hot, moist, fair amount of rain.	Used to adulterate silk.
Hemp . .	Hemp plant (canabis), hence name canvas.	Fibres in stem (and also leaf).	Very wide range. Cool, for fibre.	Italy, Russia, France. India for drug.
Esparto (or alfa) .	Esparto or Spanish grass.	Leaves.	Dry, sunny.	N. Africa, Algeria, S. Spain.
Cocoanut fibre ("coir")	Cocoanut tree.	Fibres on nut.	Tropical, best near sea.	Ceylon, Madras.
				Kernel and bud or palm cabbage for food; "milk" for drink; dried kernels (copra) for oil; juice from flowers, toddy (whence arrack).

TABLE XII

FOREST PRODUCTS: A—TIMBER

Tree.	Conditions of Growth.	Colour.	Texture.	Chief Regions.
Ash . .	Good, somewhat calcareous soil, sheltered situation.	Greyish white.	Tough, strong, elastic.	Europe, Asia.
Bass (species of lime)	Whitish.	Soft, even texture, straight grain.	Canada and U.S.A.	
Cedar . .	Any soil, at not too great altitude.	Reddish brown.	Light, coarse grain, spongy, liable to warp.	U.S.A., Canada, W. Indies, Syria, and N. Africa.
Elm . .	Low-lying land with moderate moisture.	Brownish.	Hard, heavy, liable to warp, cross-grained.	England, N. America.
Greenhart .	.	Dark green or chestnut.	Heavy, hard, durable, oily, compact grain.	
Larch . .	Any soil.	Yellowish white.	Very durable, straight grain.	East Indies.
Mahogany .	.	Reddish brown.	Straight grain, easy to work.	
Maple (or Sycamore) Pine	.	Yellowish white.	Hard, tough, durable.	Switzerland, Italy, Russia, Germany.
Oak . .	Any soil, but best in rich loam, deep subsoil.	Whitish, tinged with red.	Straight grain, strong, elastic, easy to work.	Central America.
Teak . .	Sheltered situation.	Light brown.	Durable, very straight grain, free from knots.	Canada, Eastern U.S.A., Germany, Gt. Britain.
Walnut . .	.	Straw to brown.	Very hard, oily.	Sweden, Russia, Norway, Germany, Gt. Britain.
White fir .	Climate and soil, moist.	Light brown.	Very hard, tough, elastic, fine grain.	Europe and America.
		White.	Contains hard, black knots.	S. India, Burma.
				Gt. Britain, America.
				Norway, N. America.

TABLE XII—*continued*

FOREST PRODUCTS : B OTHER THAN TIMBER

APPENDICES

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Plant.	Part of Plant.	Climatic Conditions.	Chief Regions.	Remarks.
Native Rubber	Syphoniaelaistica, Hevea lutea, Castilloa elastica.	A form of sap called Latex.	High and equable temperature, fairly copious rainfall.	Amazon basin, Africa (Congo basin), Eastern Archipelago, Bolivia and Peru, Central America.
Mastic	Lentisk—evergreen shrub.	Bark.	Sub-tropical.	Mediterranean coast, Morocco, Portugal and Canaries.
Quinine	Cinchona tree.	Extracted from bark.	from Temp. up to 70° F., plentiful rain.	Used in treatment of fever.
Sarsaparilla	Smilax (a climbing plant)	Prepared from roots.	Tropical forests.	
Lac	.	Resinous incrustation exuded from barks of trees round an insect which has punctured the bark.	Do.	E. Indies.
Coca or cuca	A plant like blackthorn.	Warms moist clearings in forest.	W. of S. America.	Cocaine and leaves.

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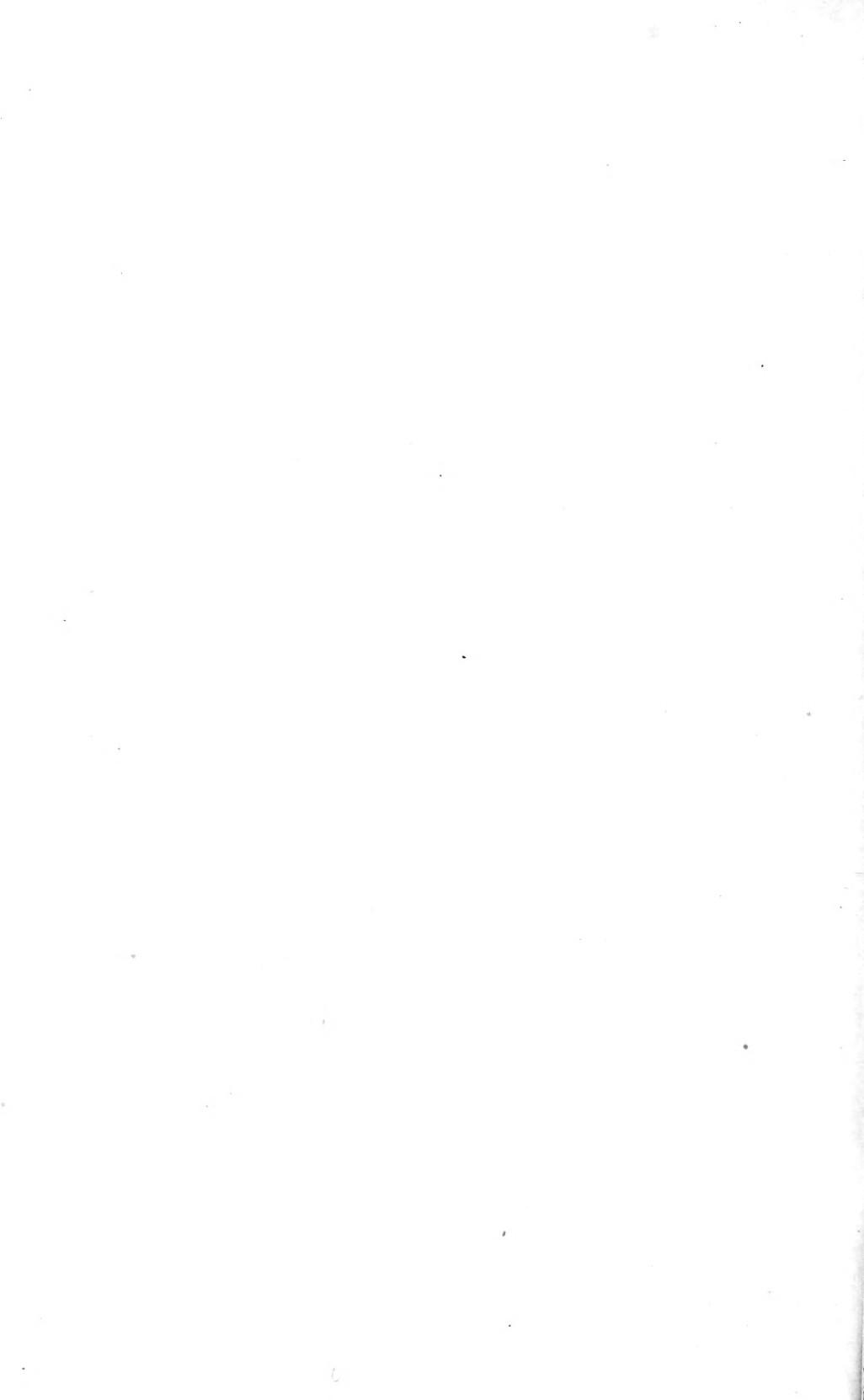
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